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SCIENTIFIC AMERICAN

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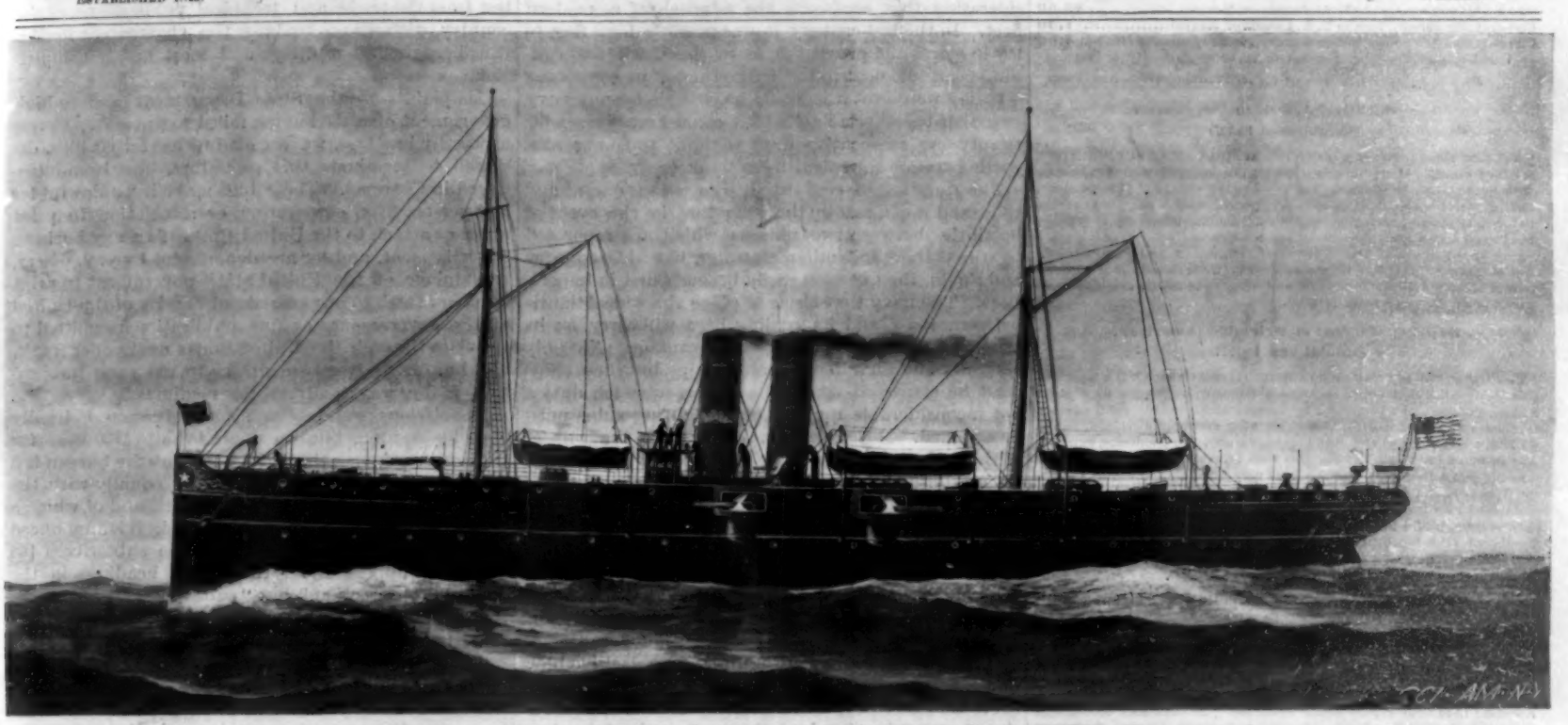


THE UNITED STATES CRUISER "TOPEKA," FORMERLY "DIOGENES."—[See page 262.]

RANGE FINDER.

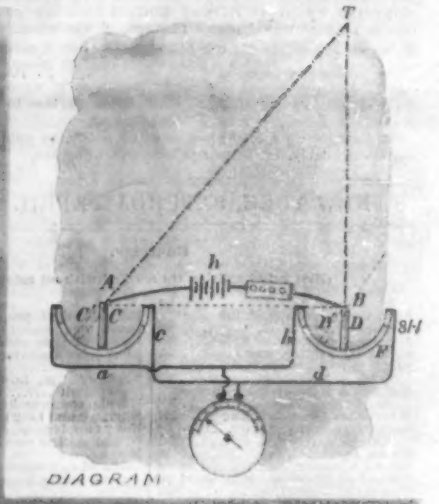
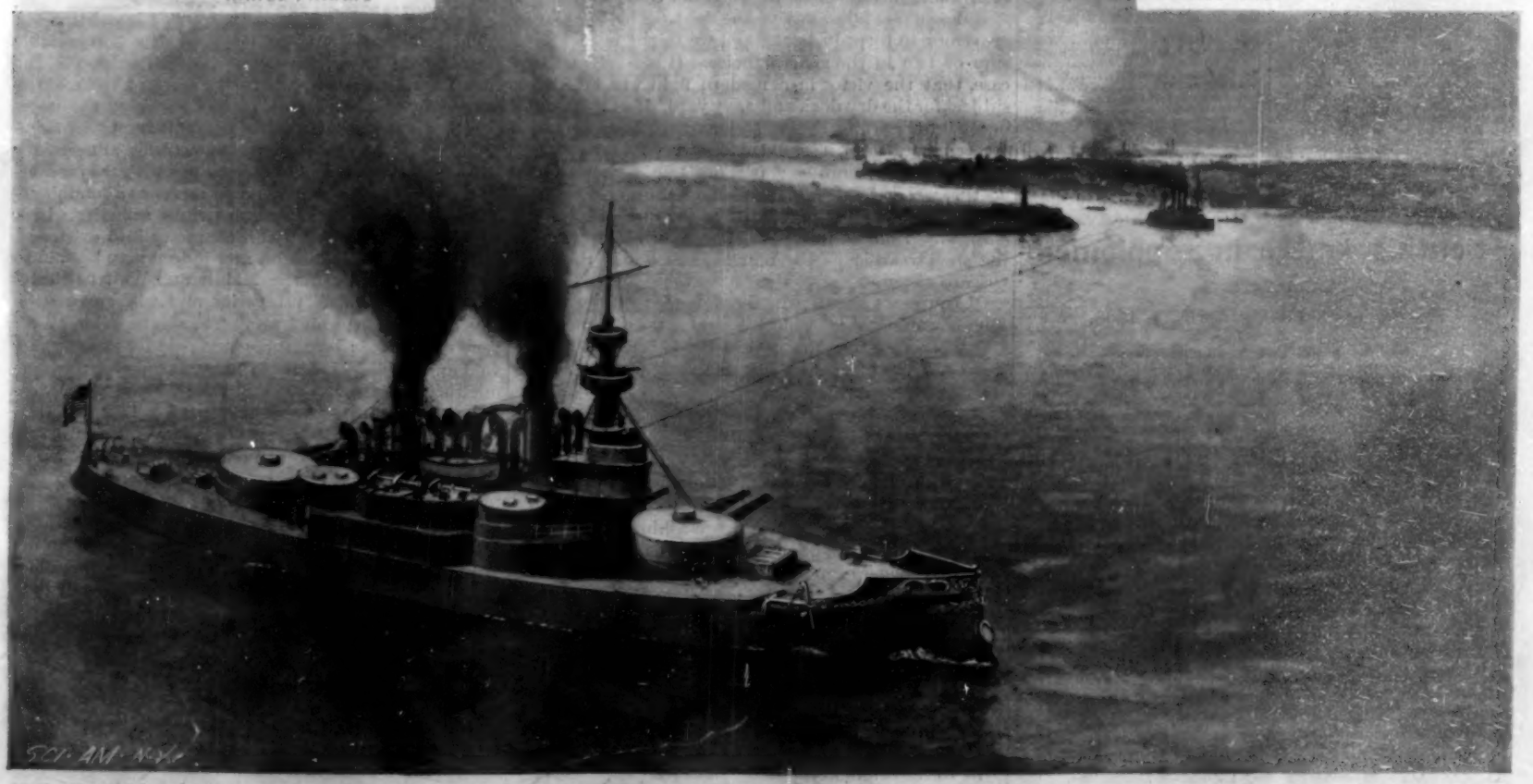


DIAGRAM.



USING THE RANGE-FINDER TO DETERMINE THE DISTANCE OF A HOSTILE SHIP.—[See page 262.]

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NEW YORK, SATURDAY, APRIL 23, 1898.

Contents.

(Illustrated articles are marked with an asterisk.)

Acetylene gas generator for home use*..... 260
Academy of Sciences, N. Y..... 262
Africa, new discoveries in..... 263
Arctic journey of Dr. Nordenskjold..... 263
Balloon, a war, at Fort Wadsworth..... 256
Bicycle lamp, an acetylene gas.* 265
Bicycle package carrier, Chapman's*..... 261
Books, new..... 268
Brown, mummy..... 265
Bureau of American Republics. 248
Clay-spouting well, a..... 261
Copyrights for artists..... 249
Cutter head, Boyd's*..... 261
Decision, trolley, another..... 262
Diet, a frugal..... 253
Eleyet, census of..... 261
Electrical news..... 257
Electrical resistance of metals at low temperatures*..... 267
Electric mail delivery..... 250
Food as affected by sewage..... 265
Foreigners excluded from German school..... 262
Gasoline yacht "Coyote"*..... 260
Government in the advertising business..... 250
Ink and colors, preparing..... 260
Inventions recently patented..... 268
Lightning rods, conductivity of. 267
Lime juice manufacture..... 263
Liquid air*..... 257
"Maine," the, how it was destroyed..... 252
Marble, compression of*..... 264
Marriage and long life..... 263
Navy supplement, special..... 250
Nickel plating wood..... 266
Notes and queries..... 268
Olive oil as a dietetic..... 263
Patent rights, negotiable paper for..... 256
Patents granted, weekly record of..... 269
Patents that pay..... 269
Photographs, faded, restoring.. 267
Plows, Lambert's*..... 261
Range finder, Fiske's*..... 257, 263
Rocks, flow of*..... 264
Sea, command of the..... 246
Science notes..... 265
Spar for vessels, Clapham's*.... 261
Submarine cables..... 267
Surgery, improved practice in... 265
Tattooing, remarkable*..... 265
Telephones in Europe..... 267
"Topeka," new cruiser*..... 257, 263

TABLE OF CONTENTS OF

Scientific American Supplement

No. 1164.

For the Week Ending April 23, 1898.

Price 10 cents. For sale by all newsdealers.

PAGE

I. BOTANY.—A Vegetable Curiosity.—1 illustration..... 18612

II. ELECTRICITY.—Electric Lighting in Rubber Works..... 18604

III. FINE ARTS.—Pulpit of Saint Bavon Church.—1 illustration..... 18609

IV. MECHANICAL ENGINEERING.—Powerful Machines for Working Structural Iron and Steel.—2 illustrations..... 18609

V. MEDICINE AND HYGIENE.—Home Modification of Milk..... 18605

VI. METEOROLOGY.—Table of Wind Pressures Adopted by the English Navy..... 18606

VII. MISCELLANEOUS:
Engineering Notes..... 18607
Miscellaneous Notes..... 18607
Selected Formulæ..... 18607

VIII. NATURAL HISTORY.—Animals Underground..... 18610
Mimicry in Insects..... 18610

IX. NAVAL ENGINEERING.—Battleship "Maine," 1895-1898.—20 illustrations..... 18598
The Navy of Spain.—9 illustrations..... 18604

X. PSYCHOLOGY.—The Psychology of Invention.—By Prof. JOSIAH ROYCE..... 18602

XI. WARFARE.—Battleship "Maine," 1895-1898.—20 illustrations..... 18598
The Navy of Spain.—9 illustrations..... 18604

THE COMMAND OF THE SEA.

In his classic work on the influence of sea power in history, Captain Mahan has shown that the command of the sea has been the decisive factor in most of the great wars of the past, and there is no reason to doubt that history will repeat itself in this respect in the event of hostilities between this country and Spain. In the present case, moreover, there will be new factors due to the change from sail to steam power entering into naval warfare which will, we think, render the command of the sea of even greater importance than it was in the days of Nelson. Chief among these is the coaling question—undoubtedly the most vital consideration that confronts the admiral of a modern fleet. In the last century it was possible for a fleet to lay in stores and provisions, extra spars, sails and running gear, sufficient to last for a cruise of many months—to-day we doubt if it would be possible for any navy to gather together a fleet which could keep the sea for twenty-one consecutive days without touching at a coaling station to replenish its bunkers.

The question of coal supply is a serious one at any time, and it can readily be seen that in the event of hostilities between two nations which are separated by three thousand miles of water, like this country and Spain, the question easily becomes first in importance. The navy that elects to place the wide Atlantic between itself and its coaling base will carry on its campaign under an enormous disadvantage. Not only must it maintain a line of coaling ships, but these ships must be convoyed across the water, to which duty a not inconsiderable number of its fighting ships must be assigned. Moreover, to make certain of the transfer of the coal to the fleets, some sort of coaling port must be established, for coaling at sea is both slow and hazardous and only capable of being carried out in fairly smooth water.

As the case now stands, Spain possesses two coaling stations in the West Indies, one at Havana and another at Porto Rico, and as Cuba would presumably be the objective point of both combatants, it is reasonable to expect that Spain would send her fleet to Cuban waters and endeavor to strike a decisive blow in a general fleet engagement. Should she be successful in this, however, she would still be under the necessity of convoying her coal ships across the Atlantic, a task which she could not hope to accomplish successfully in the face of the numerous and powerful auxiliary fleet which we shall soon have at our disposal.

On the other hand, it is quite possible that Spain may choose to place the burden of keeping open a three thousand mile line of communication upon our navy, temporarily surrendering Cuba and Porto Rico, and choosing her battle ground on the eastern side of the Atlantic. If she does this, there is no denying that we should fight at a great disadvantage, and the success of our fleet would be more problematical.

One of our first objects, if we did not rest satisfied with the acquisition of Cuba, would be to secure a base of operations within reach of Spain itself, where coal might be stored and as much refitting as did not involve a visit to the dry-dock carried out. The Canaries would furnish such a base, and it is likely that a collision between the fleets would occur in the vicinity of these islands. If we encountered the full force of the Spanish fleet, it is not to be supposed that our ships, even though victorious, as we think they would be, would come scathless out of the fight. The Spaniards are strong in torpedo boats, and we might even lose a ship or two in the general melee. It is likely, in any case, that the victor in a modern fight will be a ripe subject for the dry-dock and navy yard. If so, this would necessitate part of the victorious fleet limping home for repairs before it could follow up its advantage. This, in itself, would be a perilous trip, for shot-holes at the water line, or a few feet of the outer bottom ripped up by a glancing blow from the ram of a battleship, would not improve the chances of a ship surviving such weather as the San Francisco and the New Orleans encountered on their recent passage.

Of course we should win the struggle; but just how long it would last, or what it would cost us in men and ships, is a question that would be determined by the degree to which a nation driven to bay would prolong the despairing struggle.

RATHER SMALL BUSINESS FOR THE GOVERNMENT.

We are in receipt of a monthly magazine which is carried without charge through the mails of the country, and bears the imprint of the great United States Government Printing Office, at Washington, where it is printed at the public expense. This magazine has about 100 pages of paid advertisements, from soaps, toilet articles and cough medicines to plows and whisky distilleries. Of the magazine itself it is hardly worth while to speak seriously, its sparsely filled reading pages being made up mostly of matter such as is usually furnished in the government consular reports, with an occasional rehash of a subject more capably treated in the public press, all printed in French, Spanish and Portuguese, as well as in English.

As to the origin of this anomalous publication, it may be said that, at a session of a so called International American Conference, held at Washington, in 1890, an association was formed of which an organization bearing the style of "Bureau of American Republics" has since been the representative, for the ostensible purpose of disseminating special information likely to increase commerce between the several American republics. Such a cause is certainly a legitimate and perfectly laudable one. At first the publications of the bureau were in the nature of free handbooks, but their subsequent development into trade directories and a monthly magazine in which advertisements were published for pay, all expenses of publication being paid by the government, has called out an indignant protest from the trade and technical publications of the country, with whose business the government itself is thus brought into a direct and most unfair competition.

Complaints to the State Department and to high government officials having failed to put a stop to this unworthy business, we are glad to learn that bills, designed to terminate this procedure, have been introduced in Congress. These bills make it "unlawful for any person, firm, corporation or association to print upon or attach to the United States flag any business advertisement, and for any department bureau, officer, or employe of the United States government to print upon or attach to any official publication of the United States government, or any publication permitted to circulate through the United States mail under frank, any business advertisement, or to use such publications in any way as advertising mediums."

The obvious propriety of such legislation is hardly open to question, but we doubt whether it goes far enough, for, among the publications of the bureau is a "Commercial Directory," competing equally with the legitimate field of private publishers, and of which a first large quarto volume has appeared. It is announced that, in this directory, "the advance subscribers [$5 each] will appear under the proper headings in the United States section," but "subscribers desiring more than one heading will be accommodated at the rate of $5 for each additional classification."

Of course, it is impossible in any such directory, no matter how voluminous, to include all the names in even the leading departments of business, and, to have the directory of any value, selections of names should be made by competent and unbiased judges; but it would appear, from the announcement of the bureau, that the most insignificant houses or persons may find a place in its pages, and such houses may have their names introduced as many times as they please at the rate of $5 for each insertion. And this directory is to be put forth in annual editions, under the authority of the United States government!

It is surely inconsistent with the objects, aims and traditions of the government of the United States to engage in commercial enterprises in competition with its own citizens. Such a course would lead to the grossest abuses, and there is no more reason why the government should engage in an advertising business than that it should establish manufactories for the production of flour or sugar, or cotton or woolen goods. It is wrong in practice and wrong in principle, and it is to be hoped that the relief sought for in the bill will be promptly accorded by Congress.

NEGOTIABLE PAPER FOR PATENT RIGHTS.

The substantial re-enactment of the "Negotiable Instruments Law," passed at the last session of the New York Legislature (Chap. 612, Laws of 1897), of the practically obsolete statute of 1877 requiring the insertion of the words "Given for a patent right" in negotiable instruments taken therefor, seems unnecessary at the present day and inharmonious with the progressive spirit of the new law, but it serves as a forcible reminder of the notorious patent right swindles which first called legislation of this character into existence. The evil reached its height, and indeed may be said to have had its life, in the Middle and Western States during the period of prosperity and wild speculation which followed the civil war. The most glaring frauds were committed; large sums were paid for rights under void and worthless patents; patent rights for the same territory were sold over and over again; notes were taken to facilitate the sales, immediately discounted, and, by the time the purchaser discovered the deception, were in the hands of bona-fide holders, enforcible against the maker. The courts were powerless to protect the victims of these and other similar impositions, and the State Legislatures were finally appealed to for relief, with the result that in 1868 Ohio passed an act which required any person, before offering for sale a patent right for any county, to submit the patent to the probate judge of the county and make affidavit before him that the patent was in force and that the applicant had the right to sell, and also requiring that any written obligation taken on the sale of such right should bear on its face the words "Given for a patent right." Failure to comply with the law was made an offense.

That this statute in its entirety was of doubtful propriety seems to have been realized, for within a year

the provision requiring the making and filing of proofs was repealed. But the legislation was of the infectious character, and the Ohio statute in substantially its original form was made the law of Indiana and Illinois in 1869, of Minnesota in 1871, and of Nebraska in 1873, Kansas following their example as recently as 1889, while the law as amended in Ohio, requiring only that written obligations given for a patent right should bear such statement on their face, was passed by the legislatures of Vermont in 1870, of Michigan in 1871, of Pennsylvania and Wisconsin in 1872, of New York and Connecticut in 1877, and of Arkansas in 1891.

In the litigation which promptly followed the enactment of these statutes their constitutionality was assailed vigorously, and at first with uniform success. The first decision of importance was rendered in 1870 by the Hon. David Davis, then an associate justice of the Supreme Court of the United States, in *Ex parte* Robinson (2 Bissell 309), on a petition for a writ of *habeas corpus*. The petitioner had been arrested under the Indiana statute for offering a county right for sale without having first filed a copy of the patent and proofs required by the law. The ground of the petition was the invalidity of the statute, and Justice Davis held that the enactment was an attempt to prohibit the sale of patent rights, if the directions were not complied with, and to throw burdens on the owners of such property which Congress had not seen fit to impose upon them; that Congress under the authority given to it by the Constitution had directed the manner in which patents should be assigned and sold; that property in inventions existed by virtue of the laws of Congress and that no State had a right to interfere with its enjoyment or annex conditions to the grant; that a patentee had the right to go into the open market anywhere in the United States and sell his property; that, if this were not so, a State might impose terms which would prohibit any sale, and thus nullify the laws of Congress and destroy the power conferred upon it by the Constitution; and that the law in question attempted to punish by fine and imprisonment an act which the national legislature had authorized, and was therefore void, and the petitioner was discharged.

The Supreme Court of Illinois, in 1873, of Minnesota, in 1876, and of Nebraska, in 1883, following the decision in *Ex parte* Robinson, declared that statutes substantially the same as that of Indiana were void (Hollida v. Hunt, 70 Ill. 109; Crittenden v. White, 23 Minn. 26; Wilch v. Phillips, 14 Brown, Neb. 134); but in 1885 the Supreme Court of Indiana decided that the authority of *Ex parte* Robinson had been overthrown by the Supreme Court of the United States, in 1878, in Patterson v. Kentucky (97 U. S. 501), and overruling its own previous decision (Helm v. First National Bank, 43 Ind. 167), in which the section of the act relating to negotiable instruments was declared void, sustained the section of the statute requiring the filing of proofs (Brechbill, v. Randall, 102 Ind 528), and this decision was followed in the later Indiana cases, New v. Walker (108 Ind. 366) and Sandage v. Studebaker (142 Ind. 148), and also in Kansas (Mason v. McLeod, 57 Kansas 108).

The conflict between these authorities is direct and irreconcilable. The statute has been sustained by the Supreme Courts of Indiana and Kansas, but it has been declared invalid by courts of equal standing in Illinois, Minnesota and Nebraska, as well as by the Federal Court in Indiana. The weight of reason and of authority are decidedly against the validity of the statute. It cannot be denied that a law which requires the owner of a patent right or his agent to appear personally before an official in every county of the State, and make and file with him an affidavit and a copy of his patent before offering to sell a State right, is an onerous restriction upon the enjoyment of the property right secured to him by Congress. Nor can it be properly said that the offering of a patent right for sale honestly and fairly, irrespective of the character of the patent, is *per se* an act so harmful to the welfare of the community as to justify its prevention or regulation by the exercise of the police power of the State. It is true that the Supreme Courts of Indiana and Kansas have decided otherwise, but these decisions are both based upon the erroneous propositions first enunciated in Brechbill v. Randall (supra), that the Supreme Court of the United States, in Patterson v. Kentucky, held that the sale of the incorporeal rights granted to a patentee may be regulated by a State under the proper exercise of its police power, and that the same case overruled *Ex parte* Robinson. What the Supreme Court did hold was that the prohibition of the sale of an illuminating oil, which it was admitted could not possibly be made to conform to the State standard of safety, was a proper exercise of the police power of the State, and the mere fact that the oil was patented did not relieve the patentee from a compliance with the State requirements. The court recognized the difference between the incorporeal right secured by the patent and the right to sell the patented article, and expressly decided that the former "may be secured and protected by national authority against all interference." Instead of overruling *Ex parte* Robinson, that decision was tacitly approved.

Quite as serious is the conflict as to the law requiring the insertion in written obligations of the words, "Given for a patent right," adopted by the States of Vermont, Connecticut, New York, Pennsylvania, Ohio, Indiana, Illinois, Michigan, Wisconsin, Minnesota, Kansas, Arkansas and Nebraska. It has been declared unconstitutional by the highest State courts in Indiana (since overruled), Illinois, Michigan, Minnesota and Nebraska and by the United States Circuit Courts in the Southern District of Ohio and in the District of Indiana (Helm v. First National Bank, 43 Ind. 167; Hollida v. Hunt, 70 Ill. 109; Cranson v. Smith, 37 Mich. 309; Crittenden v. White, 23 Minn. 24; Wilch v. Phillips, 14 Brown (Neb.) 134; Woollen v. Banker (U. S. Ct. Ct. Ohio) 2 Flippen 33; Castle v. Hutchinson (U. S. Ct. Ct. Ind.) 25 Fed. Rep. 394); while its validity has been sustained by the courts of last resort in New York, Pennsylvania, Ohio, Indiana, Kansas (Herdic v. Roessler, 109 N. Y. 127; Haskell v. Jones, 86 Pa. St. 173; Shires v. Commonwealth, 120 Pa. St. 368; Tod v. Wick Brothers, 36 Ohio St. 370; New v. Walker, 108 Ind. 366; Sandage v. Studebaker, 142 Ind. 148; McLeod v. Mason, 57 Kansas 108). On this point, while the rulings of the courts are more evenly balanced, it is believed that those against the validity of the law preponderate. The Indiana decision (New v. Palmer), followed in Kansas, held that the enactment of the statute was a proper exercise of the police power resident in the State; but, as pointed out, Patterson v. Kentucky, relied upon as authority for this proposition, does not sustain it. The New York Court of Appeals in Herdic v. Roessler (supra) withheld its approval of the Indiana and Kansas doctrine, and, following the Ohio and Pennsylvania decisions, held that, while a State law which interfered with the exclusive right granted to inventors would be void, the New York statute did not interfere therewith, as it operated only upon the thing taken for the right when that was a negotiable instrument. It is true that primarily it does operate upon the thing taken, but it also operates upon the patentee's chance of disposing of his property, and places and was intended to place a restriction upon the free and unrestricted right to transfer it given to him by Congress. That was the sole object and purpose of the law, which says to the owner that he may not, under pain of fine and imprisonment, sell his property, his incorporeal right, and take therefor a promissory note, entitled to the special protection afforded to negotiable paper by the law merchant. If this be lawful, the State may lawfully place its prohibition upon other forms of contract and other descriptions of consideration, imposing terms "which would result in a prohibition of the sale of this species of property within its borders and nullify the laws of Congress."

Until, however, the validity of these statutes is brought before the United States Supreme Court—if that should ever be—their validity must be regarded as finally established, as far as the State courts of New York, Pennsylvania, Ohio, Indiana and Kansas are concerned. That they will be declared unconstitutional and void, if ever brought before the Supreme Court, is hardly to be doubted. That has been the attitude of every Federal judge who has passed upon the question.

SHALL ARTISTS COPYRIGHT THEIR WORK?

One of our architectural contemporaries, in speaking of the decorations of the new Appellate Court House in New York City, has taken the opportunity to criticise American sculptors and mural painters for copyrighting their works. There is also considerable talk concerning the copyrighting of decorations by artists in the Congressional Library, at Washington, as many think that, as the artists were paid for their works by the United States government, they should lose all control over their productions as soon as they had been paid for.

The journal referred to says that it is considered by the people generally "to be a discreditable piece of sharp practice on the part of the artists, for their work was paid for by the public and from the public treasury," and, to encourage great decorative work among the people, reproductions of these decorations should be disseminated as widely as possible. This contention is a one-sided one, and fails to do the artists justice. We have taken pains to consult some of the most eminent exponents of the arts of painting, sculpture and architecture, and they are unanimous in their opinion that their labors should be protected by copyright.

The artist looks at the question from another point of view than the layman. The money received from royalties on reproductions of their achievements is often inconsiderable and is regarded by the artist as a wholly secondary matter. But what the artists do wish is to keep absolute control of the reproductions of their works. Manufacturing concerns are quick to realize the advantage of having artistic advertising matter, and they seize with avidity any design which suits their fancy, provided it is not copyrighted. No artist cares to see the creatures of his brain affixed to a box of cigars or on bottles of patent medicines, and it is unfortunate that some famous American pictures have been treated in such a way.

Artists wish not only to say who shall reproduce their paintings and statues, but how they shall be reproduced. No one would be better pleased than they if good photographs or photo-engravings of their works could be sold for the most moderate prices, as such sales would tend to popularize their work; but in all cases they must be able to approve of the reproductions before they are put on the market. Unfortunately, most of the photographs of works of American masters have been got out in so large and costly a form that their purchase is limited to those in easy circumstances.

Illustrated newspapers frequently desire to present by the half tone process the work of the painters and sculptors. This is, of course, greatly to the advantage of the artists, provided that the reproductions are adequate, and, the works being copyrighted, enable the artists to select such papers as they wish and to pass on the proofs of the engravings.

In architecture there is the same necessity of having the plans and elevations copyrighted. The architects who are building a large religious edifice in New York copyrighted their drawings, thus preventing a representation of the building which they are constructing being used by a cement firm for advertising purposes. Examples where copyright has been beneficial to artists are almost endless, and we can see no reasonable ground for complaint, if they use the means which the law has put at their disposal for the protection of their artistic property.

OUR SPECIAL NAVY SUPPLEMENT.

The great demand for information regarding our navy which has arisen from the present crisis has brought out the fact that although excellent descriptions of the various ships have appeared from time to time, there is yet wanting a concise, accurate and fully illustrated compendium of the United States navy of the kind which the public is just now demanding. In saying this we are, of course, aware that some excellent histories of the navy have been published; but we think that the very wealth of detail which they contain makes them too bulky and perhaps a little too technical to meet the demand of the hour. On the other hand there are publications which contain excellent illustrations, but suffer from a paucity of information.

In the belief that the right kind of work on the subject to meet the present want has yet to appear, we shall publish in a few days THE SCIENTIFIC AMERICAN SPECIAL NAVY SUPPLEMENT. It will commence with a historical review of the period of reconstruction, 1883 to 1898, and following this will be an article explaining by diagrams the various types of warships and their classification. The bulk of the number will be taken up with the description of the typical ships, commencing with the "first line of battle" in the shape of such vessels as the "Indiana" and "Iowa," and concluding with the torpedo boats. Full tables of the ships, guns, dock yards, etc., will be given at the end of the number, and accompanying it will be a beautifully colored map of Cuba, showing its relation to our coast and other islands.

The text and engravings will not be confined to the exterior of the ships; but the internal arrangements, turrets, engines, magazines, steering gear, etc., will be illustrated and described in a clear and not too technical manner.

ELECTRIC MAIL DELIVERY.

In Geneva a novel system for delivering letters in high apartment houses is to be tried. On the ground floor is arranged a cabinet having as many compartments and boxes as there are floors in the house. When a letter is deposited in any box, it makes a contact which rings a bell on the corresponding floor. The bell can only be stopped by the removal of the letter. The same current that rings the bell opens a valve connected with a water tank in the top of the house. Here are located cylinders attached by cords and pulleys to the letter boxes and so arranged that when they are filled with water they will serve to haul up the letter box and its contents to the proper floor. When the box arrives, the letter is automatically dumped into a stationary receptacle and at the same time the cylinder is discharged of its water. The letter box then descends to the lower floor, the bell stops ringing and it remains in position waiting for the next visit of the postman

To mend broken meerschaum proceed as follows: Rub together casein and waterglass to a smooth paste, and add to the same sufficient magnesia to make a white cement, and use at once, smearing both of the broken surfaces before uniting. Press well together and hold in place for a few moments. The paste sets at once, and only sufficient for immediate needs should be made up. White of egg and magnesia are also recommended. We commend, however, the first process, which we have found reliable.—American Druggist.

ACETYLENE GAS GENERATOR.

A SIMPLE, SAFE AND INEXPENSIVE APPARATUS THAT MAY BE CONSTRUCTED AT HOME.

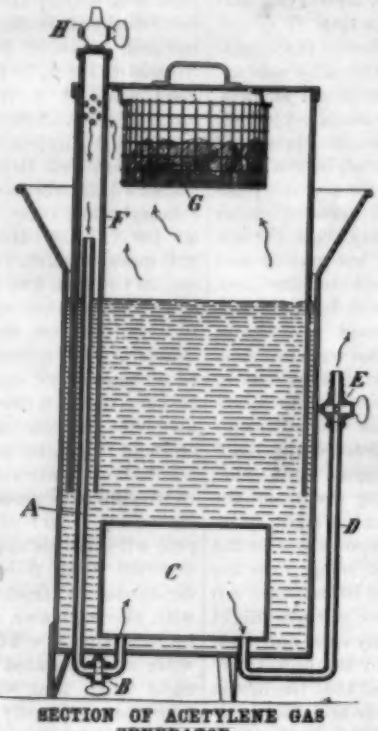
Acetylene gas as developed thus far is practically new, although the gas and the calcium carbide from which it is produced have been known to chemists for some time, but the cost of the carbide has been so high it was beyond commercial use until about two years ago, when improved methods of making it from coke and lime by an electric process brought the price within a reasonable figure.

The gas is produced by wetting calcium carbide with water. When carbide is immersed in water, the gas will be seen to rise in bubbles through the water and pass off into the air. The calcium carbide, which is in the form of irregular lumps, can be purchased for about fifteen cents a pound. It is non-explosive and is inactive except when submitted to the action of water. To obtain the gas for use it will be necessary to make a generator. The one shown in the illustration is in the form of a small gas tank in which the gas can be made and contained, and from which it may be drawn for use through pipes and rubber tubes.

The generator is made of galvanized sheet iron and is provided with legs as shown.

This work will necessarily have to be done by a tinsmith, some one handy with soldering iron. It can be laid out by the aid of the sectional view.

SIMPLE ACETYLENE GAS GENERATOR.



SECTION OF ACETYLENE GAS GENERATOR.

The cylinder forming the tank is eighteen inches high and twelve inches in diameter, with a strong watertight bottom soldered on it. Around the top there is a flaring collar four inches high. Another cylinder is made nineteen inches high and eleven inches and a half in diameter, with a gastight top soldered to it. With these two cylinders, one to fit within the other, the generator can be made. A piece of three-eighths inch brass pipe twenty inches long, another one ten inches long, and still another one four inches long, and two short pieces each an inch long are required.

These pieces of pipe should be threaded at both ends to fit other connections. Three elbows, one stopcock to receive a pipe at both ends, another with a hose end on it, and still another one that may be plain are required. A watertight cylinder eight inches in diameter and six inches high is necessary. This is soldered fast to the middle of the bottom in the tank by means of three short legs which will allow the water to pass under it as shown in Fig. 1. This cylinder occupies the position shown at C and is the gas cooler. A hole is made in the bottom of the tank an inch from the edge and through it is passed the long pipe, A, having at the bottom the pet cock, B. A small pipe passes up through the bottom and into the washing bottle. These parts are all well soldered bottom.

A short piece of pipe extends from the bottom of the cooler at the opposite side and connects with an elbow attached to the 4 inch length. The short piece of pipe is connected by another elbow to the 10-inch standing pipe, D, that extends up the outside of the tank, and is provided at the top with the pet cock, E, to which the hose is attached. The stand pipe, F, should be braced near the top by a metal strap soldered fast to the side of the tank. Three angle legs, three or four inches high, are soldered fast to the bottom of the tank, as shown.

In the top of the movable or inside cylinder at the edge, a hole two inches in diameter is cut, through which passes a piece of two-inch galvanized leader pipe, F, which extends three inches above the top, and at the upper end of the two-inch pipe a cap is soldered. In the center of this cap a pet cock, H, is inserted and soldered. This two-inch pipe is soldered to the movable cylinder, and directly under the top of the movable cylinder are punched a number of small holes to let the gas through.

On the top of the movable cylinder a handle is soldered, and from hooks projecting from the under side of the top is suspended a basket, G, made of galvanized screen wire. The calcium carbide is held in the basket, G. With several coats of enamel paint on both the inside and outside of the cylinders, the generator will then be ready for use.

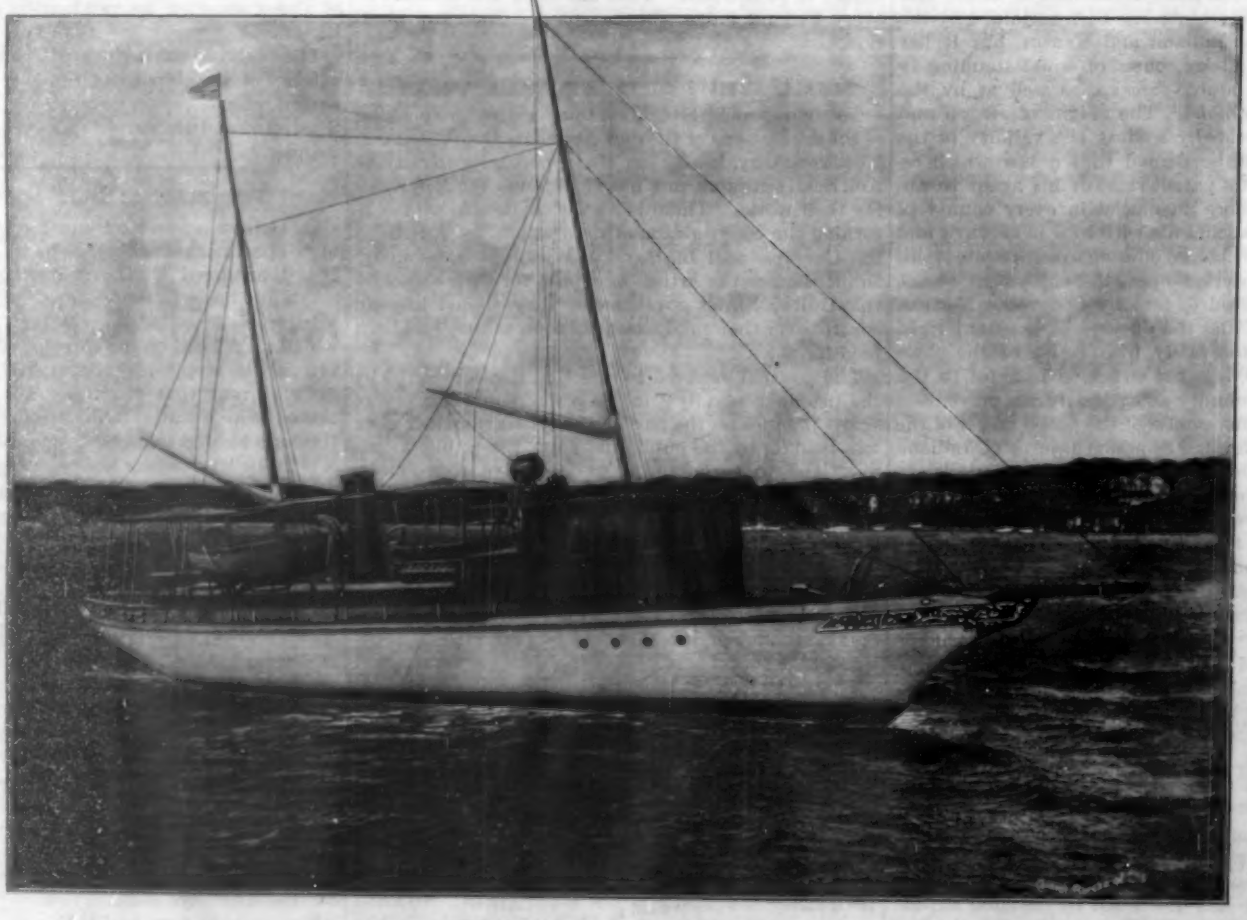
To charge the generator a pound or two of calcium carbide is placed in the basket, which is hung on the hooks inside the top of the movable cylinder. The tank is filled with water. The cocks, B and E, are closed and the movable cylinder is inserted in the tank in such a position that the pipe, F, will fit over the stand pipe, A. Open the pet cock, H, at the top of pipe, F, and the cylinder will slowly sink in the water as the inclosed air escapes through the pet cock, H, and when the carbide touches the water, gas will immediately begin to generate, when the movable cylinder rises.

If the pet cock, H, is closed and the pet cock, B, is opened, the gas will then go down the stand pipe, A, into the cooler, C, and be ready to escape through pipe, D, as soon as pet cock, E, is opened. The object of the cooler, C, is to cool the gas before it passes through the gas tips, as cool gas gives a better and clearer light than warm gas. This generator, while seemingly intricate, is quite a simple affair, as will be found when it is complete. JOSEPH H. ADAMS.

A COMMODIOUS GASOLINE YACHT.

The accompanying illustration represents a large, beautiful, and highly efficient gasoline yacht recently built by the Daimler Motor Company, of Long Island City, N. Y., for Mr. Eugene Peters, of Washington, D. C. Its length over all is 86 feet, beam 14 feet, and draught 4 feet, and it registers 36 tons. It is run by two 25 horse power Daimler motors, and has twin screws, improved reversing gear and carbureter, all of the latest design. The yacht made on her trial trip twelve and a half miles an hour, and it is expected that she will readily develop a speed of thirteen miles an hour or more. The cost of running is very low, as the two motors consume only about five to six gallons of gasoline per hour, making the expense for fuel probably below fifty cents an hour. A two horse power stationary Daimler motor drives a dynamo which affords light for the whole yacht and a powerful search light.

The cabins are very elaborately finished, and the yacht has a fine pilot house, a main saloon, kitchen, forecastle for the quarters of the crew, bathroom, engine room, smoking room, and three staterooms. It is designed to carry sufficient fuel for three hundred hours' actual run, and, there being no boilers and coal bunkers, considerable additional room is afforded as compared with that which can be utilized in a steam yacht of similar proportions. No government licensed engineer is required, and one man attends to all the machinery, thus reducing to a minimum the cost of running the yacht. Her owner intends to take her south in a few days, and to cruise on her throughout the year.



THE GASOLINE YACHT "COYOTE."

MARRIAGE, according to Dr. Schwartz, of Berlin, is the most important factor in longevity. Of every 200 persons who reach the age of 40 years, 125 are married and 75 unmarried. At 60 years the proportions are 48 to 22; at 70 years, 27 to 11; and at 90 years, 9 to 3. Fifty centenarians had all been married. The doctor asserts that the rate of mortality for husbands and wives between the ages of 30 and 45 years is 16 per cent, while that for unmarried persons is 25 per cent.

A BICYCLE PACKAGE CARRIER.

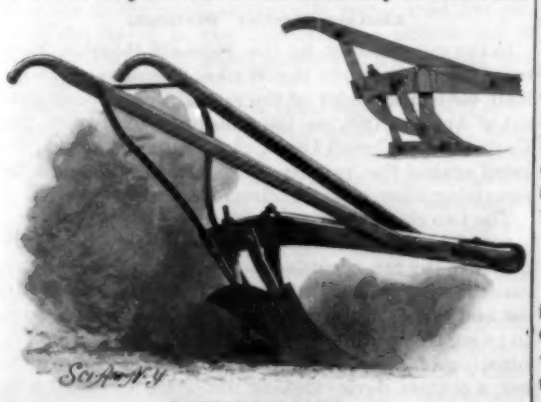
A device adapted for convenient attachment to bicycles, and especially designed to carry the ordinary rectangular lunch boxes so often used by workmen, is shown in the illustration, and has been patented by G. Griffith Clapham, of Roslyn, L. I., N. Y. Its main portion is formed of two metallic plates bent upward at their ends to constitute a resilient frame, in which the box is held by the pressure of the spring arms of

CLAPHAM'S BICYCLE PACKAGE CARRIER.

the frame. It is fastened to the backstays and central brace of the bicycle frame by means of legs, those extending to the backstays being formed of a bar of metal bent into approximately U-shape, and the carrier being rockably held on the horizontal intermediate portion. The ends of the legs have eyes, each adapted to receive a thumb screw carried by clips on the backstays. The leg extending to the central brace is hinged to the front of the frame, and its free end has an eye receiving a thumb screw that passes through jaws of a clip on the brace, permitting the leg to be readily connected and disconnected. To give the parts steadiness, with a slight yielding action, a spring arm attached to the frame plate has a jaw embracing the forward leg, the arm swinging horizontally when released from the leg, and being adapted for engagement with a finger on one of the upright members of the frame when the carrier is folded to one side, as indicated by the dotted lines, which may be readily done by loosening and tightening the thumb screws. The entire device may also be readily disconnected from or attached to the machine.

AN IMPROVED PLOW.

The illustration represents a plow of such construction that the point and the landside may be raised and



LAMBERT'S PLOW.

lowered, one independently of the other, the handle of the plow being also independently raised and lowered. The plow also has a peculiar form of stock consisting of side members adjustable on the beam, and a main member pivoted between the side members and capable of forward and rear movement on the beam, as shown more in detail in the small view, the main member of the stock being adapted to carry the share. The improvement has been patented by Henry B. Lambert, of Tangipahoa, La., and the large view is made from a photograph of a plow which the inventor has had in practical use. The stock is preferably made shorter than the ordinary stock, and the handles are pivotally attached thereto, the aperture for the bolt in the beam being horizontally elongated so that the handles may be adjusted backward and forward, while the construction of the clevis enables the operator to give the plow more or less land, and to plow close to cotton, corn, etc., while the horse walks at one side of the line of the furrow. The stock has two side arms curved downwardly and forwardly and a central main arm, all three arms connected at the bottom by a bolt, and the upper ends of the side arms being adjustably attached to the beam, whereby the stock may be raised or lowered at will, while the central main arm may be secured in desired position, forward or backward along the stock. Two curved uprights or braces extend from the lower portion of the side arms to an adjustable connection with the handle, and also have an adjustable pivotal connection with the beam, whereby the handles may be raised or lowered, and the uprights carried upward or downward to regulate the position of the side arms. The landside is pivoted at its forward end between the sections of the stock, and an adjusting bar, extending upward through the beam, is pivotally attached to the inner face of the landside at its free end. The landside is reinforced at the rear portion of its outer or wearing face by an attached bar, which may be readily replaced when worn out, and the plowshare and point are bolted to a flange secured to the lower portion of the central main arm of the stock. When this arm is moved forward it throws the point of the plow down and the forward end of the beam up, thus causing the plow to take the ground well in grass and trash where ordinary plows would choke, the adjusting bar also enabling the operator to raise or lower the landside to suit the character of the ground being plowed.

The Census of Egypt.

The statistics of the census taken last June of what is called Egypt proper—that is, Egypt up to Wady Halfa—have been classified elaborately by Boinet Bey of the Finance Ministry, says The London Times. The main results are as follows:

In 1846, under Mohammed Ali, the population was estimated at only 4,500,000; the census of 1882, which was a most imperfect one, showed over 6,750,000; and last year's, which may be considered as fairly accurate as is practicable, indicates a total population of nearly 9,750,000. Of this total 50·8 per cent are males, and 49·2 per cent females. After deductions for women, children under seven years, and Bedouins, it is calculated that 12 per cent of the males can read and write, the remainder being entirely illiterate. The native Egyptians number 9,008,000, to which must be added 40,000 originally from other parts of the Ottoman Empire and 574,000 Bedouins. Of these last only 89,000 are really nomads, the remainder being styled semi-sedentary.

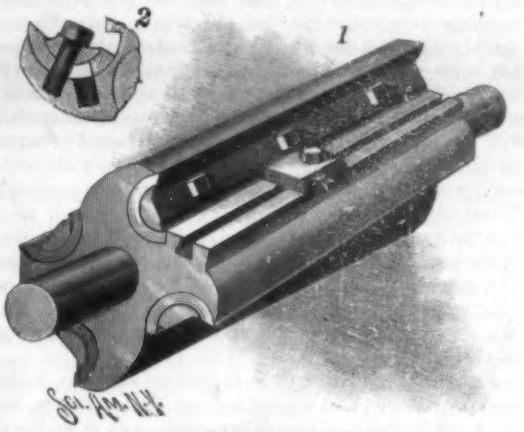
Of foreign residents there are 112,500, of whom the Greeks are the most numerous, with 38,000; then come the Italians, 24,500; British (including 6,500 Maltese and 5,000 of the army of occupation), 19,500; French (including 4,000 Algerians and Tunisians), 14,000; Austrians, 7,000; Russians, 1,400; Germans, 1,300; and the remainder are divided among 10 different nationalities. The classification according to religion shows nearly 9,000,000 Moslems, 730,000 Christians, and 25,000 Israelites. The Christians include the Coptic race, numbering about 608,000, of whom only a very small proportion profess the Roman Catholic and Protestant faiths. Among the town populations Cairo contains 570,000; Alexandria, 320,000; Tantah (the largest town in the interior of the delta), 57,000; Zagazig and Mansurah (the next in importance) 35,000 each; Port Said, 42,000; Ismailia, nearly 7,000; and Suez, 17,000. From these figures it may be gathered that over 50,000 persons derive their living from the Suez Canal. Assiut (the largest town of Upper Egypt) contains 42,000, and Keneh ranks next with 24,000. The total number of centers of population, comprising towns, villages, farm settlements and Bedouin encampments, is given as 18,129.

A Clay-spouting Well.

The government artesian well at Lower Brule agency is certainly a freak of its kind, says The Omaha Bee. Originally the pressure threw a solid six-inch stream of water to a height of twenty-one feet above the top of the well casing. Subsequently the pipe became temporarily choked up, and at such times the water would not flow at all for periods of two or three days. Then without apparent cause the pipe would suddenly become clear and the water would again spout to the height of twenty-one feet. After continuing for a few days, during which time it almost constantly spouted large quantities of sand, it would once more become choked and cease to flow. This became so frequent and regular that in time the agency employes became accustomed to it and paid no particular attention to the freakiness of the well, which is constantly under their observation. But now the matter has taken another and more peculiar turn. Arrivals from the agency report that, commencing about three weeks ago, the well has been at intervals forcing out apparently endless quantities of blue clay. This in itself is nothing strange, but the manner in which the clay is carried through the pipe is something out of the ordinary. The blue clay entirely fills the six-inch pipe and arises slowly above the top of the casing, exactly as sausages emerge from a sausage machine, until the top is so high in the air that it becomes overbalanced, when five or six feet topples over upon the ground. The continued upward movement of the clay in a few minutes causes more of the column to topple over. This has continued until circular pieces of the blue clay aggregating several hundred feet in length have been deposited on the ground adjacent to the well, necessitating the employment of men to remove the huge deposits before the top of the casing becomes completely buried. The discharges of blue clay are accompanied by very little water, and the clay, probably from the great pressure required to force it through the well casing, is always as dry and hard as a brick. Another peculiarity is that these eruptions invariably commence a short time prior to the advent of windy or stormy weather and continue until the weather again becomes settled.

AN IMPROVED WOODWORKING TOOL.

The accompanying engraving represents a cutter head for planers and other machines, designed to readily cut rough, cross-grained and knotty lumber very smooth, without tearing up the grain or jerking out the knots. The tool is also designed to be run at a high rate of speed, to allow a mill owner to advantageously work up stock that might otherwise be disposed of as culls. The improvement has been patented by George R. Boyd, of Cairo, Ill. It comprises a cylindri-

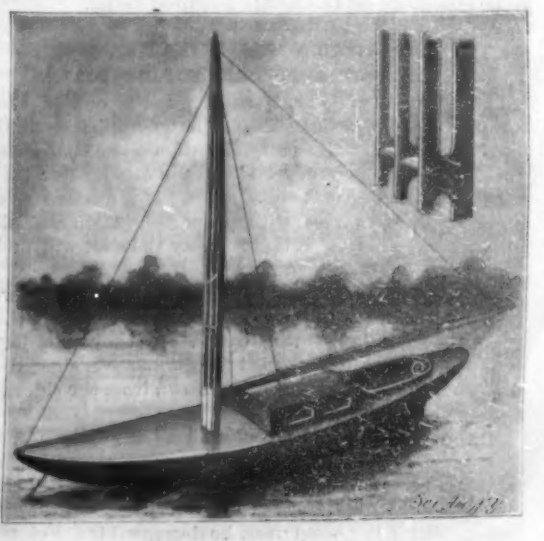


BOYD'S CUTTER HEAD.

cal body in which are longitudinal segmental grooves in which segmental cutters are adjustably held. Each segmental knife is engaged at its top surface by a correspondingly shaped key fastened in place by set screws extending through elongated slots in the cutters, and the segmental grooves form lips to engage the cutter close to its cutting edge, the outer surface of each lip forming part of the cylindrical surface of the body. The cutting edge of each cutter stands slightly beyond the cylindrical surface of the lip, so that chips are not liable to pass between the lip and the cutter. Each of the keys, as shown in the small section, Fig. 2, has a flange at one side and a cut-away portion at the other side, to admit of the keys being reversed when the cutters are ground down. On two oppositely arranged lips of the segmental grooves are dovetailed projections which carry bead-cutters, engaged by a clamping plate, these cutters being employed to form beads on boards used for ceilings, etc.

A LIGHT AND STRONG SPAR FOR VESSELS.

A spar which is designed to offer but little resistance to the wind, and which is yet light and strong, is shown in the accompanying illustration, and has been patented by Thomas Clapham, of Roslyn, L. I., N. Y. The improvement is equally applicable to the mast, boom, gaff, bowsprit, and consists in building up these parts of longitudinal strips, instead of making them solid, as heretofore customary. The



CLAPHAM'S SPAR FOR VESSELS.

strips are preferably rounded at their edges, and the spars and mast may have slots or openings, as shown in the small figure, to further reduce weight and lessen the wind resistance, the strips being pressed apart by blocks to increase their strength and stiffness.

OUR NEW CRUISER "TOPEKA."

It was announced by the American Embassy at London, on April 2, that the United States had purchased a second-class cruiser of 1,800 tons displacement, and which had a speed of 16 knots per hour. It was soon known that this boat was the "Diogenes," which was built for Peru in 1883. She never became the property of that country, owing to financial complications, and she remained in the possession of the Thames Shipbuilding Company. She lay in the Thames for more than ten years, and it was not until the Chinese-Japanese trouble that she was sought after. She then became the property of Japan, and was fitted with Maxim guns. Open hostilities, however, prevented her from leaving English waters, and since then she has been lying in the Thames awaiting a purchaser, and she was finally bought for the United States navy by Lieut. Colwell, the United States naval attaché, who hoisted the United States flag over her on April 2.

The "Topeka" is 350 feet long, her beam is 35 feet and she has a draught of about 10 feet. She has twin screw engines, which are below the water line. Her machinery is in excellent condition, and required but little overhauling to prepare her for her trip to this country. During her trial trip, when she made 16 knots speed per hour, she burned only about 60 tons of coal for 24 hours. She could have gone 10 knots an hour with the consumption of 25 tons of coal. This second-class cruiser will be particularly valuable to the United States, owing to the fact that her draught is only about 10 feet. She is thus admirably adapted as a river gunboat. When building, the "Topeka" was brig rigged, as it was then intended she should be devoted to cruising purposes. The rigging has now been changed to that of a schooner. She has two bow chasers on the forecastle deck and one stern chaser on the poop. The Maxim guns are carried on sponsons and have a range of 120 degrees.

At soon as the cruiser was purchased she was coaled and provisioned and started for the United States, but on April 9 she put into Weymouth, owing to heavy weather. She started again for New York on April 13 in company with the gunboat "Somers," which was built in Germany. A cable dispatch from London, dated April 15, says that the vessels have arrived at Falmouth, and that the "Somers" appeared to be partially disabled. The explanation of the purchase of such a small cruiser as the "Topeka" is that she would be more effective for service than the steam yachts and tugs recently acquired and now being converted into auxiliary gunboats. It is contended by the naval authorities that, if the United States is to buy a number of small vessels not capable for service against any of the Spanish war vessels now in preparation for service, it is better to get regular warships than those of the merchant marine, which must be largely built over for naval purposes. The "Topeka" is more like the cruisers "Marblehead," "Detroit" and "Montgomery" than any other vessels in the United States navy.

This is probably the first case in which a warship was ever bought by telephone, for the new cruiser was purchased in a hurried manner; in fact, the negotiations were carried on over the telephone. After the verbal agreement had been made Lieut. Colwell immediately started for the Thames Iron Works to raise the American flag over the newly acquired vessel.

THE RANGE-FINDER FOR DETERMINING THE DISTANCE OF A HOSTILE SHIP OR FORT.

The accuracy of modern rifled guns is one of the wonders of engineering. Two experimental shots fired a few years ago at the same elevation from the same gun fell within thirty yards of each other, after traversing a distance of twelve miles. If a modern rifle is laid upon the target, with proper elevation and allowance for windage, it is safe to say the shot will find the mark.

The correct elevation of the gun can only be determined if the distance of the target is known, and the exact determination of the distance of a moving object is a problem that has worried the gunner ever since the day when round shot was first thrown from the sides of the wooden fighting ship.

In the early days, the determination of the range was a matter of guesswork. The gunner assumed a distance, elevated his gun accordingly and watched the course of the shot. If it fell short, he increased the elevation, and if it passed over, he decreased it.

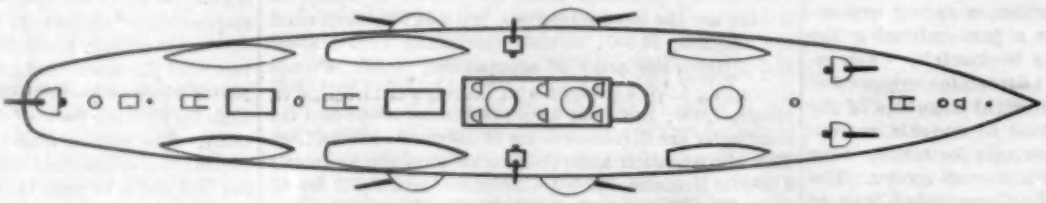
This was all very well in a day when the guns were too feeble to do much execution, except at close range, and a few dozen shots thrown away made little impression upon a ship's magazines. With the advent of modern ordnance, however, with its 60-ton guns and costly charges, the necessity of accurate fire became imperative, and ordnance experts set about devising some scientific method of finding the range at sea. The earliest and best known device of the kind was the invention of Lieut. Fiske, of the United States navy, which has been installed on many of our ships and is widely in use in the various navies of the world.

The Fiske range-finder is based upon the well known principles of land surveying with the transit and engineer's chain. If a surveying party come to a broad river whose width has to be determined, a base line is measured along the bank, and the angles which this line makes with a mark on the opposite bank are measured by the transit. Then, knowing the length of the base line and the two angles, the distance across the river can be determined by trigonometry.

Applying this to the range-finder, a base line is carefully measured between two points near opposite ends of the ship, and over each point a range-finder, answering to the engineer's transit, is permanently set up. If the telescopes of the two finders are simultaneously converged upon the same point on a distant object (ship, fortress or city), the observers will be in possession of the trigonometrical data necessary to compute the distance, namely, the base and the two base angles.

In the din, hurry and slaughter of a sea fight, however, it would be difficult to make the necessary calculations, as the distance between the ships, and therefore the observed angles, keeps changing, and in order to make the determination of the distance automatic, Lieut. Fiske placed his telescopes in the circuit of a Wheatstone bridge and caused their change of position to record the distance of the object on the graduated scale of a delicate galvanometer. All that was now necessary was for the observers at the two range-finders to keep the cross-hairs of the telescope upon the same point of the ship, and the electric current translated (as it were) the angles into distances and recorded them by the movement of a needle over an arc graduated into hundreds and thousands of yards.

On our front page are illustrations which will make the operation of this most ingenious instrument clear to the reader. It represents the "Indiana" about to open fire upon a hostile ship. The converging lines are drawn from two range-finders, which are placed in elevated positions above either end of the superstructure deck. These finders are permanent fixtures, and the distance between them is accurately known. The smaller cuts show a range-finder and a diagram of the telescopes and the electrical connections.



DECK PLAN OF THE CRUISER "TOPEKA."

The range-finder consists of a powerful telescope, which is mounted on a standard and is capable of horizontal rotation above a graduated disk. Upon the disk, and extending an equal distance on each side of the zero point on the graduation, is a metallic contact arc. Fixed to the telescope standards is a contact strip, which rotates with the telescope and slides over the contact arcs. In the diagram A and B represent the centers of the disks on two range-finders and C and D the arms that carry the telescopes and contact strips, which are shown sliding in contact with their arcs. The electric current from the battery, h, passes through the centers or pivots, A and B, and then into the arcs. From the right-hand arc it circulates in the wires, b and d, from the left-hand arc in the wires, a and c, and traverses the galvanometer.

When the two telescopes are parallel, the equilibrium of the Wheatstone bridge is complete and consequently the needle of the galvanometer shows no deflection. This equilibrium occurs, moreover, whatever be the position of the telescopes on the dial, provided that they are perfectly parallel. But if the telescope, C, for example, be turned until it is in the position, C', the parallelism being destroyed, and, along with it, the equilibrium of the two parts of the bridge, the needle of the galvanometer will be deflected. This deflection will increase in proportion to the length of the arc traversed by the telescope.

But since the arc, CC', is proportional to the angle at A, which is equal to the angle at T, it follows that the deflection of the galvanometer will be proportional to the angle at T, or to the distance, AT. Hence by graduating it in hundreds and thousands of yards, the distance of the ship or fort, T, may be read directly from the galvanometer. One of these galvanometers is placed in the conning tower and one at each of the principal gun stations.

It will be seen from the illustration that the operator, on applying his eye to the telescope, has opposite to his mouth a telephone transmitter, a receiver being clamped to his ear. By this means the two operators are kept in constant communication and the errors are avoided that would be caused by the reading of a deflection produced before one or other of the telescopes is well directed toward the point to be observed.

New York Academy of Sciences.

The fifth annual reception and exhibition of the recent progress of science of this society occurred on Wednesday and Thursday, April 13 and 14, at the American Museum of Natural History in this city, and attracted many visitors and members. Fifteen different departments of science were represented, each having something novel and interesting to exhibit. On the night of the 13th Mr. Charles E. Tripler lectured on Liquid Air and gave a demonstration of its qualities. He had on the platform a good sized vat of liquid air, and made numerous and amusing experiments.

His experiments were many and amusing. An egg dipped into the vat became as hard as a rock, and when struck with a hammer broke into bits as though made of stone. A piece of rubber pipe became so hard that it could be snapped like a stick, while the effect of the air on a piece of metal tubing was to corrode it so that it could easily be broken in the hands.

At the conclusion of the lecture Mr. Tripler dumped his vat of liquid air out on the platform, to the consternation of the people sitting in the front rows, who imagined they were going to get wet. It all went up in smoke, however.

On the evening of the 14th Prof. George E. Hale, of the University of Chicago, lectured on the Progress of Astronomical Science and had on exhibition a number of photographs of the buildings and instruments of the Yerkes Observatory, of which he is the Director.

Among other exhibits were those of the Jesup North Pacific expedition, including a number of facial paintings of Indians of the North Pacific coast, in the department of ethnology and archæology.

Hiram Maxim's Opinion.

Cable dispatches from London, dated April 15, say that Hiram Maxim, the inventor of rapid-fire guns, thinks the expected war between the United States and Spain will be terribly one-sided, and that the result is a foregone conclusion. He says: "Any superiority which the Spaniards have in the number of ships is overwhelmingly counterbalanced by the greater strength, equipment and speed of the American warships. Spain has no resources in the way of production of steel or the building of ships, while America's resources are thoroughly adequate."

Another Trolley Decision.

In the suit brought by the Thomson-Houston Electric Company against the Walker Company, of Cleveland, for infringement of the second Van Depoele patent of April 11, 1893, on the under-running trolley, the United States Circuit Court of Appeals, on April 9, decided against the validity of the two important claims remaining after previous adverse decisions.

The two claims in controversy were:

"(1) The combination of a car, an overhead conductor above the car, a contact device making underneath contact with the conductor, and an arm carried by the car and carrying the contact device and pivoted so as to swing freely around a vertical axis; and (2) the combination of a car, an overhead conductor above the car, a contact device making underneath contact with the conductor, and an arm on the car, movable on both a vertical and a transverse axis and carrying the contact device."

It was insisted for the appellants that the two claims in controversy were for the same combinations specified in some of the claims of the earlier patent of April 1, 1890. The appellee contended that they were not, because they omitted to specify any means for holding the contact device in underneath contact with a conductor, and consequently could be construed as covering a sub-combination in which such means were not employed, or if such means must be read into the claims by implication, the claims were not limited to the means described in the specification, and that upon either construction they were not the claims of the earlier patent. The court held with the appellants that the contact device in question was that specified in the first patent, and that the claims are invalid.

THE French school at Delphi has lately unearthed two slabs of limestone which bear an inscription which is of great interest, dating, as it does, from the fourth century before Christ. This inscription, which consists of about two hundred lines, gives the price of work for building operations in Greece at the period named, and from it we learn that an architect was paid less than $150 per annum.

Correspondence.

How the "Maine" was Destroyed.

To the Editor of the SCIENTIFIC AMERICAN:

I was very much impressed and stirred by your illustrations of the "Maine" report, as well as by the admirable editorial. I have just been writing to the leading English engineering papers, calling the attention of their readers to your issue of this date and to the fact that you give in those illustrations proof, absolute and unchallengeable, of the major fact that that unfortunate crew was murdered. Can you not send marked copies to all your foreign exchanges? I think it supremely important that every engineer, the world around, should understand this matter; for the engineers, more than any other class, will guide the opinion of the rest of the world.

If you care to have me do so, also, I will distribute a few copies to prominent men of my acquaintance abroad. We cannot too promptly and too fully expose this evidence before all nations; for we want the intelligent backing of the world in what we are about undertaking as a nation. Yours very truly,

R. H. THURSTON, Director.

Sibley College, Cornell University, Ithaca, N. Y.
April 9, 1898.

[In view of the general interest that has been taken in the "Maine" report, and especially in the official drawings, which we believe were first opened to public inspection through the columns of the SCIENTIFIC AMERICAN, it has been decided to publish the history of the ill-fated vessel from the time of its launching to the terrible disaster in Havana Harbor, and a full account will be found in the current issue of the SUPPLEMENT.—ED.]

New Discoveries in Africa.

It was reported recently that a young man named H. S. H. Cavendish, who has titled relations, a fortune, and proclivities as a sportsman, had been murdered in Somaliland. The story of the tragedy was spoiled the other day, when Mr. Cavendish turned up in London with an account of his extensive travels in East Africa and the interesting discoveries he had made. He was away only a little over a year, and he and the eighty men in his caravan had exciting adventures with the natives, who gave him some hard fights. Of course, the Gallas got the worst of these encounters, and Cavendish did not lose a man during the year's journey, which is a remarkable record.

He says he found coal both east and west of Lake Rudolf that burned well, and there was a good deal of it. If his report is accurate, this news is interesting, for coal has not been found hitherto in any part of tropical Africa, except for some distance along the Zambesi River.

Most of the region around the two lakes, Stefanie and Rudolf, is pitted with ancient craters, and Cavendish found the most remarkable crater that has yet been discovered in the district. The natives call it Sodigo Vo, and it is about a mile and a half wide and 1,300 feet deep.

His predecessors in this lake region were Teleki, Donaldson Smith and Bottego, none of whom have given the world any idea of the country to the west of Lake Rudolf. It may be, however, that the records of the Bottego expedition, a part of which were recovered after the massacre of his party, will contain information about the west side of the lake, for it is said that Bottego visited that district. Cavendish supplies the first information of that region.

He ascended a mountain 5,000 feet high, at the north end of Lake Rudolf, from which he had an extensive view of the country to the west. He says it is a mass of mountains, entirely uninhabited and exceedingly difficult to traverse. He journed west of the lake and traced the whole of the west shore, hitherto unplotted on our maps. For a width of about fifty miles it is quite flat, when the land rises suddenly into the mountains. It is subject to very great variations, often flooding the country all around.

Count Teleki found at the south end of Lake Rudolf the only active volcano then known in Africa. Two years ago Dr. Donaldson Smith found this volcano still in a state of eruption, but Cavendish now reports that it has been shattered by a great convulsion, and where it stood there is now a plain of lava. He discovered another lake south of Rudolf in which was a volcano that had also been shattered, killing the fish in the lake, whose bodies covered the shores.

Round the shores of Lake Stefanie the explorer had some excellent sport, and it was here that he was caught by a wounded elephant. "My escape," said Mr. Cavendish, "was nothing less than miraculous. The great beast, mad with rage, was charging me, when at the critical moment my gun failed, and I had to turn and run. But the elephant soon caught me, and going on his knees tried to pin me to the ground with his tusks. Failing in this, he caught me with his trunk and flung me round under his body, with the idea of crushing me to death. How I escaped I do not know, as I was in this situation for half an hour. At the end of that time the great brute got up, and kicking a piece of wood which he doubtless took to be my dead body, made off to his retreat. Curiously enough, I had no bones broken, but I was covered with blood."

Mr. Cavendish is only 21 years old. He has certainly had some remarkable experiences, and has brought home information of value, says The New York Sun.

The Manufacture of Lime Juice.

When limes are freshly squeezed, the juice is always very turbid, owing to the presence of mucilage and extractive matter derived from the fleshy part of the fruit. This is what makes it necessary to clarify it. The same difficulty occurs in lemons, but the yield of juice from lemons is much greater than that from limes, indeed, the yield from limes is very small, and the freshly expressed juice always contains a large amount of pulp. This, however, on standing for a few weeks, separates out, and a clear, sherry-colored liquid (the true lime juice) is obtained, and can either be siphoned or decanted off. If time is no object, then the process of natural settling may be observed economically, but even then it is probable that upon storage the clear, sherry-colored juice will get turbid, owing to the decomposition of mucilaginous matters which may still be in suspension. There are two courses open; either treat the juice in the manner which we are about to describe, or else allow it to stand for a few weeks, and then treat the clear liquid which is obtained, using the same process in this case also. This process is very simple, and simply amounts to heating the juice to a temperature not lower than 150° or higher than 160° F. If the temperature is carried above this point, alteration will take place, and a noticeable flavor will be communicated to the juice. While the juice is still hot, it should be filtered, and almost any filtering medium will do. On the whole, we recommend crushed quartz, graded and arranged in the filtering vessel in such a way that the larger pieces are at the bottom of the vessel, while the smallest fragments are at the top. If this process is performed shortly after the harvesting of the fruit, the juice will, under ordinary conditions, keep good for twelve months. But if the juice is intended for exportation, then it may be prevented from decomposition, and rendered fit for transit, by mixing it with one-tenth of proof spirit. This is Schweitzer's recommendation. If the flavor, however, is not objected to, there is a cheaper method of preserving the juice after it has been heated and filtered, and this simply consists in adding one per cent of bisulphite of calcium. When ready for the market, the specific gravity should be 1044·18, the precentage of citric acid should attain 8·66, and that of the ash obtained by evaporation and incineration, 0·401.—M. W. Trade Review.

Berlin Educational Institution Excludes Foreigners.

A decree has been issued by the government at Berlin which greatly interests American students. The decree forbids the further attendance of foreigners in the machinery and engineering department of the Berlin High School. It is thought that this is the forerunner of other decrees excluding foreigners from other similar institutions in Germany. One of the conservative papers has the following, from which it may be judged that the German people as a whole are rather in favor of the illiberal policy of the Prussian authorities at Berlin. The Deutsche Zeitung remarks: "At the non-Prussian high schools at Munich, Dresden, Stuttgart, Carlsruhe, Darmstadt and Brunswick there are 1,200 foreigners out of 8,682 students. We hope that, as the foreigners use their knowledge to the detriment of German industry, the non-Prussian governments will forthwith exclude them." It is learned that for some time past there has been an exchange of views between Prussia and the other German governments on this subject, and there is no telling how soon the policy may become general throughout Germany. The following expression by a high German official indicates the feeling on the subject: "There is no question that the German technological schools and industrial and scientific institutions will soon be forced to adopt a less liberal policy with foreigners. The tricks of trade we have been teaching them so long are now being used against us to the great injury of our industry."

Dr. Nordenskjold's Journey.

Dr. Nordenskjöld, of Stockholm, has arrived at Ottawa on his way to the Yukon, where he will conduct certain scientific observations in behalf of the University of Upsala. He is not going to limit his observations to the gold fields proper, but will make an extensive journey through the sub-Arctic regions of the Dominion. He will also endeavor to learn something of the fate of Herr Andrée who started last July in a balloon to cross the Polar region. Dr. Nordenskjöld has not lost hope that Andrée is still alive and thinks it is possible he has crossed the Arctic Sea and landed on the northern coast of Alaska or in the Mackenzie River basin.

Science Notes.

The United States government has sent Mr. B. E. Fernow, chief of the Division of Forestry, to Hawaii to make preliminary explorations and a report on desirable forestry legislation.

The extra consumption of illuminating gas due to fog is well illustrated by some figures given out by London, England, gas companies. These figures reveal the fact that the excess of gas used due to a fog lasting an entire day would be sufficient to supply a town of from 10,000 to 20,000 inhabitants for a year. The total consumption on such a day is about 150,000,000 cubic feet, costing about $120,000, of which amount $40,000 was necessary to pay for the excess due to fog.

According to a French writer named Potrie, whose conclusions are quoted in The Medical News, twenty per cent of all cannibals eat the dead in order to glorify them; nineteen per cent eat great warriors in order that they may inherit their courage, and eat dead children in order to renew their youth; ten per cent partake of their near relatives from religious motives, either in connection with initiatory rites or to glorify deities, and five per cent feast for hatred in order to avenge themselves upon their enemies. Those who devour human flesh because of famine are reckoned as eighteen per cent. In short, deducting all these, there remains only a proportion of twenty-four per cent who partake of human flesh because they prefer it to other means of alimentation.

There is a Jew, a native of Litsk, Russia, living in the East End of London, who has fasted for twenty years, his sole daily diet during that time consisting of six pints of milk, three pints of beer and a half pound of Demerara sugar. His name is Morris Fox. He is an excellent Talmudical scholar, and in spite of his frugal meals, he is the most healthy, intelligent and wideawake person in his quarter. He is now over forty. At the age of seventeen, it appears, he caught some lingering fever, which shattered his constitution and entirely destroyed his digestive organs. He took many kinds of treatment from many physicians, until his stomach became inured to all medicine. At the Kieff Hospital they vainly tried to cure him by sponging and electrolysis; at Vienna his physicians included the well-known Drs. Albert and Northnagel. His treatment at Carlsbad was a failure; then he traveled to Königsberg, when the physicians decided that he must live on sugar, milk and beer. He adopted their prescription, and soon regained normal health. For twenty years no solid food has passed his mouth.

Medical authorities are generally agreed as to the value of olive oil medicinally, finding it also a potent agent for any defects of the excretory ducts, especially the skin; eczema has rapidly disappeared upon a discontinuance of starch foods and the substitution of a diet of fresh and dried fruits, milk, eggs and olive oil. The beneficial effects of the latter, when thus taken in conjunction with a fruit diet, have frequently been remarked in respect to the hair, nails and scalp, quickly cleaning the latter of scurf, and supplying to the sebaceous glands the oily substance which they secrete when in a healthy condition, and the absence of which is the cause of debility of the hair, frequently ending in baldness. It has long been observed that those who treat olive oil as a common article of food, and use it as such, are generally healthier and in better condition than those who do not, and its therapeutic and prophylactic properties are very favorably regarded by medical men. It is known to be destructive to certain forms of micro-organic life, and for the eradication of such from the system its internal use has been successfully resorted to.

Among important results of investigations of food as affected by sewage is the statement that animals fed on sewage farms are, under certain conditions, liable to have their flesh and secretions changed by the herbs and grasses—produced by the sewage—upon which they feed. If the sewage on a given farm be so managed that no more of it be put into the soil than any given crop can adequately deal with, it is asserted that the crop will, under these conditions, be sweet and natural, and that the cattle or other animals fed on it will also be sweet and natural. On the other hand, if the soil be gorged to repletion with sewage, then the crops will be surcharged with sewage elements and unfit for food; the meat and milk of animals derived from such crops will also be like the crops, and unpleasant to the taste as well as dangerous to the health. The consistency of these hospital statements is made evident by the well-known fact that, if a cow is fed on turnips, her milk will within twenty-four hours taste of turnips, the intensity of the turnip flavor being the measure of the quantity of turnips taken. In the case of hens and their eggs a like result follows. If hens are fed on decaying matter, which they will eat greedily, both their eggs and flesh will be disagreeable and unwholesome eating. In respect to ducks the facts are much more striking, for, being unclean feeders, an abundance of garbage will lead them to refuse corn and similar food, so that their flesh is most pungent to the taste and, to many persons, a source of disorder.

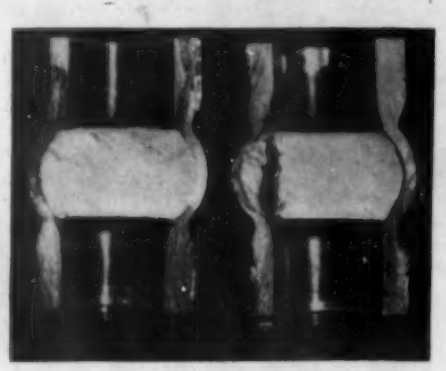
A

RECENT EXPERIMENTS ON THE FLOW OF ROCKS CARRIED OUT AT McGILL UNIVERSITY.

Some very interesting experiments on the flow of rocks are now being carried out by Prof. Adams and Prof. Nicolson, of McGill University, Montreal, and in a paper read before the Geological Society of America, at its Montreal meeting, last December, a brief account of the methods which are being employed and the results so far obtained was presented.

The authors point out that the fact that rocks, under the conditions to which they are subjected in many parts of the earth's crust, become bent and twisted in the most complicated manner, as recognized by the earliest geologists, and we have only to look at the detailed sections of Heim, Baltzer and others to convince ourselves that in many cases even the hardest rocks have moved like so much dough, and that in many cases there has been a marked transfer or "flow" of material from one point to another.

IRON TUBE AND MARBLE COLUMN.



SECTION OF IRON TUBE AND MARBLE AFTER PRESSURE.

The exact manner in which this contortion with concomitant flowing has taken place is, however, a matter concerning which there has been much discussion and a wide divergence of opinion. Heim, however, in his great work on the mechanism of mountain making, published some twenty years since, enlarges upon the very valuable results which might be obtained in elucidation of these questions from a carefully conducted series of experiments upon the deformation of rocks under conditions as nearly as possible approximating those which obtain in the deeper parts of our earth's crust. From the results obtained under known conditions he believed that we might learn much concerning the conditions under which known results were produced.

Three chief factors, it is pointed out, contribute toward bringing about the conditions to which rocks are subjected in the deeper parts of the earth's crust.

1. Great pressure from every direction. 2. High temperature. 3. The action of percolating waters.

In the present experiments the attempt has been made to reproduce only the first of these conditions in the case of a single rock; in subsequent experiments the endeavor will be made to reproduce all three of them, making use of several different rocks.

Pure Carrara marble has been employed, and this has been slowly deformed under great pressure while completely inclosed in a material having a much higher elastic limit than the marble and possessing at the same time a very considerable ductility. Under such conditions the marble cannot break, even when submitted to a pressure far above that which under ordinary conditions would be required to crush it; for it is inclosed on all sides by a stronger substance, and, the pressure being increased, it will remain intact until the elastic limit of the inclosing material has been passed, when it will commence to move, acting in this way as water or any other inclosed fluid might.

After a long series of experiments on various alloys, it was found that none possessed a sufficiently high elastic limit combined with the required ductility except certain aluminum bronzes, which, however, it was difficult to obtain with constant composition and properties. Wrought iron tubing of a peculiar construction was then experimented upon and found to fulfill the required conditions.

Another series of experiments was then made in order to ascertain the best method of inclosing the rock in the metal so as to secure a perfect contact of the two at all points, and thus prevent the breaking of the rock at some point where it lacked support. As a result of these experiments, the following procedure was adopted:

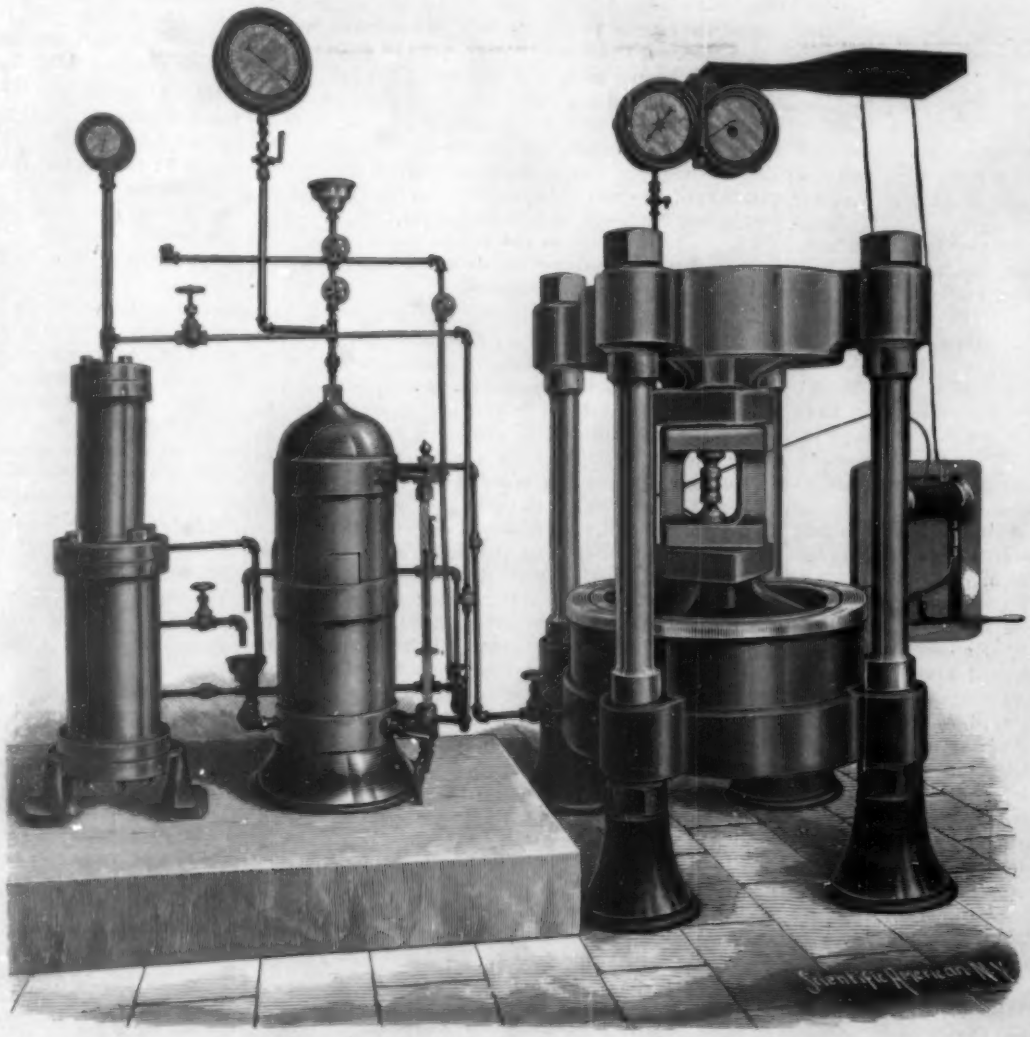
Columns of the marble, 1 cm., 2 cm. or 2·5 cm. in diameter and 4 cm. in length, were very accurately turned and polished. Heavy wrought iron tubes were then made, imitating the plan adopted in the construction of ordnance, by rolling long strips of Swedish iron around a bar of soft iron and welding the strips to the bar as they were rolled around it. The core of soft iron composing the bar was then bored out, leaving a tube of welded Swedish iron, 6 mm. thick, so constructed that the fibers of the iron run around the tube instead of being parallel to its length.

The tube was then very accurately fitted around the marble. This was accomplished by giving a very slight taper to both the column and the interior of the tube, and so arranging it that the marble would only pass about half way into the tube, when cold. The tube was then expanded by heating, so as to allow the marble to pass completely into it and leave about 3 centimeters of the tube free at either end. On allowing the tube to cool, a perfect contact between the iron and marble was obtained and it was no longer possible to withdraw the latter. The middle portion of the tube was then turned down so as to make the walls here somewhat thinner and thus localize the position of the flow. Any very slight failure to fit, if such failure existed in any case, was rendered harmless by the fact that, under a comparatively low pressure, the limestone is found to be sufficiently elastic not only to fill up any such minute space, but even to stretch the tube, and on relief of the pressure to contract again to its original volume, so that it would drop out of the tube which had been thus enlarged.

Into either end of the tube containing the small column an accurately fitting steel plug was inserted, and by means of these the marble was submitted to a pressure far above that which would be sufficient to crush it if not so inclosed. The machine employed to give the pressure was so arranged that the pressure might be maintained for weeks or even months if necessary. Under these circumstances the conditions of pressure to which the marble is subjected are those in the "zone of flow" in our earth's crust, those namely of being submitted to a pressure above that of its elastic limit, yet being unable to break in the ordinary manner, owing to the tube having a still higher elastic limit. Under the pressure, which was applied gradually and in some cases continued for several weeks, the tube was found to slowly bulge until a well marked enlargement of that portion of it surrounding the marble had taken place.

The machine used in these experiments is shown in the accompanying photograph. It was designed by Prof. Nicolson, and built for the most part in the machine shops of McGill University. It is a hydraulic accumulator which, starting with the ordinary pressure of the water mains, namely, 130 pounds to the square inch, can be made to increase this until small columns of the strongest steel may be crushed, and, as has been mentioned, a constant pressure may be maintained and recorded for months if necessary. The photograph shows the arrangement of the tube and plugs, and a distinct bulging of the former, the pressure in this case having been continuously applied for ten days previous to the taking of the photograph, the marble within the tube at the time the photograph was taken being under a pressure of about 80,000 pounds to the square inch. The small boiler on the left is not attached to the machine, but is intended for some future experiments in which the deformation will be carried out under a high steam pressure.

After the completion of the experiment the tube was cut through longitudinally by means of a milling machine, along two lines opposite one another. The marble within was still firm, and held the respective sides of the tube, now completely separated, so firmly together that it was impossible, without mechanical aids, to tear them apart. By means of a wedge, however, they could be separated, splitting the marble through longitudinally. The marble column, in one experiment, was reduced to one-half its original height. When the tube with the inclosed marble is thus cut in two, the marble may often be detached without breaking it further by a smart blow of a hammer on the back of the tube—in other cases it adheres more firmly. The exterior, where it was in contact with the tube, is smooth, and conforms to the curve of the bulging iron, its surface reproducing perfectly all the fine tool marks on the iron.



APPARATUS FOR EXPERIMENTING ON THE FLOW OF ROCKS UNDER PRESSURE.

It differs somewhat in appearance from the original rock in possessing a dead white color, somewhat like chalk, the glistening cleavage surfaces of the calcite being no longer visible, and the difference being well brought out in certain cases, owing to the fact that a certain portion of the original marble often remains unaltered and unaffected by the pressure. This, when present, has the form of two blunt cones whose bases are the original ends of the columns resting against the ends of the steel plugs, while the apices extend into the mass of the deformed marble and point toward one another. These cones, as is well known, are developed in all cases where cubes of rock are crushed in the testing machine in the ordinary manner. They never constitute any large proportion of the whole mass, and in some cases are absent or but faintly indicated, but there is always in immediate contact with the ends of the steel plugs a thin cake at least of marble possessing the characters of the original rock. The deformed marble is uniform and

compact, and seems to break with equal ease in all directions, and although not so hard as the original rock, is still firm, and especially so when the deformation has been carried out very slowly.

No accurate measurements of its strength have yet been made, but it will withstand a sharp blow, and a fragment of it weighing ten grammes has been allowed to fall through a height of eight feet on to a wooden platform, from which it rebounded without breaking.

When thin sections of the deformed marble are examined under the microscope, the nature of the movement which has taken place is clearly shown. If the deformation has been rapid, that is to say, if a column 40 mm. in length has been reduced to two-thirds of its length in five or six hours, a distinct cataclastic structure can be seen along certain lines of motion, though this is often on so minute a scale that a high power is necessary to make it clearly visible. This cataclastic structure is precisely like that seen in the rocks of many highly contorted districts.

When, however, the deformation is carried out very slowly, as, for instance, in one experiment where the column was reduced from 40 mm. to 35 mm. in height, the movement being very gradual and extending over thirteen days, the cataclastic structure is absent. In these cases the grains still fit closely together and are of substantially the same size as in the uncrushed marble. Well marked strain shadows, indicating a twisting of the grains, are common, with, in some places, an elongation of certain of the grains in one plane. The dull, chalky color of the deformed rock in those cases is chiefly due to a fibrous structure which developed in the calcite and which, in most cases, when magnified, is seen to be due to a very fine polysynthetic twinning, which is often so exceedingly fine that it can be recognized as such only by the use of very high powers. Each individual of calcite, in fact, has changed its shape and relative position, either by twisting or by slowly moving along its gliding planes, the chalky aspect of the granulated rock being apparently chiefly due to this repeated twinning destroying the continuity of the cleavage surfaces of the calcite, thus making the reflecting surfaces much smaller.

The experiments, therefore, show that marble, even when dry and at ordinary temperatures, does under great pressure develop a certain degree of plasticity and can be made to flow, and that this movement consists chiefly in a bending of the constituent calcite individuals or a shearing along their gliding planes. All the microscopic structures present in the rock are found in the highly contorted limestones of many mountain regions; although many of these present, in addition, certain other structures which indicate that the conditions under which the movements in their case took place were not exactly those of the experiment, but that moisture and possibly heat played a part as well.

The experiments are now being continued, a modification of the machine having been arranged whereby the pressure may be applied while the rock is maintained at a temperature of from 100° C. to 250° C. When these are completed, it is intended to try the effect of compression in the presence of steam at a high temperature, and results of great interest to the physicist and geologist may be expected.

LAOTIAN TATTOOING.

Our thanks are due to Prof. Frank T. Adams, who has kindly sent us photographs of the apparatus used in the experiments, and who has furnished us with the above particulars.

TROY, with the ruins Schliemann explored, has been presented to the imperial Osmanie museum of antiquities at Constantinople by the owner of Hissarlik, the Englishman, Frank Calverley.

THE ART OF TATTOOING.

Tattooing has been studied from many points of view. It is very widely practiced, and has various origins. It is due to religious ideas, forms distinctive signs among tribes, is offered as a recompense to the valiant, or, finally, is a true initiation marking the passage from childhood to the adult age.

JAPANESE TATTOOING UPON THE BODY OF A WEALTHY AMERICAN.

It is practiced in different ways: by burns which form scars (as among the Australians); by wide incisions (as among the Africans); or, finally, by fine punctures, and in this case becomes an art. It is from the latter viewpoint that we desire to examine it.

The greater the perfection to which a race has brought its art, the handsomer will be its tattooing. The Australians are acquainted with very primitive drawing only. They trace straight parallel lines or angles upon their arms and their few utensils. They have not reached the conception of the polygon, curve or spiral. They are ignorant of symmetry, alternation, and the various principles that preside over the grouping of ornamental designs. So their tattooing is rude, and composed simply of a few parallel or intersecting lines or of dotted ones. The African worshipers of fetiches, whose art is very crude, trace lines and angles, which the repeat in series; but make very little use of curves.

NEW ZEALAND TATTOOING UPON A FUNERAL STATUE.

Opposed to these are the Polynesians, whose ornamental art is considerably developed. They know how to draw curves and spirals; and they combine geometrical lines in such a way as to obtain harmonious results. So they tattoo very complicated and very beautiful designs. In New Zealand the figures are supercharged with close and parallel curves, which surround the mouth, nose and eyes. In the Marquesas Islands travelers have admired the perfection and fineness of the lines of tattooing practiced there, and in which figures of animals are harmoniously mixed with geometrical designs, upon the human body as well as upon sculptured objects. These tattooing designs, like the ornamental art of the natives, have, according to the testimony of travelers, varied since the discovery of these islands.

The ornamental art of New Guinea is highly developed, but tattooing is not much practiced. However, the women of the Motu tribe tattoo themselves, and do it with a perfection that cedes in nothing to the art as practiced by the Polynesians.

The Americans have taught us to admire the very original art of the Haidah, a people of Colombia, who represent man and the animals according to regular curves that give them the appearance of geometrical designs. Their tattooing is in every respect like the designs which they sculpture upon wood, and it suffices to see a specimen of it in order to recognize it among a thousand others.

Tattooing therefore constitutes an artistic manifestation, and not one of the least, of primitive races. It even happens that, as regards the Guanches of the Canary Islands, it is the principal art of this race that remains to us. These people did not tattoo themselves in the proper sense of the word (which signifies a puncture of the skin into which a coloring substance is introduced), but printed designs upon the body by means of matrices or "pintaderos." The Museum of Las Palmas (Canary Islands) possesses a fine collection of these matrices in which we can see what was the ornamental art of this race, which has now disappeared. The Guanches were acquainted with polygonal figures, drew the rose ornament, and inscribed figures one within another—the circle in a square, the rose ornament in a circle, etc. They opposed and alternated designs and even knew how to arrange figures according to a double plan of symmetry; but they were ignorant of those complicated figures of which Greek art later on made so excellent use.

In the extreme East, on the contrary, tattooing is not composed of geometrical designs. Sino-Japanese art has abandoned them in our day, although it formerly employed them, as may be seen from some ritualistic vases that have been preserved. The artist now applies himself to a faithful reproduction of animals and of plants, or else conceives fantastic monsters. So the tattooing is purely figurative. Those so handsomely draped women that are found upon the Japanese Kakemonos are observed again in a no less pleasing form in the tattooings. Men, monsters and flowers form the decorative motive.

So, too, the Laotians delineate upon the skin those monsters and fantastic figures that are so dear to the Chinese imagination. Linear tattooing is not practiced.

In Burma, the Hindoo style prevails. The tattooing figures are those of men, trees and scenes from life.

Among us, the art of tattooing is left to the lower class; so it is a degraded art. The representations are coarse, and, as a general thing, poorly executed. Sometimes the artist is capable of drawing very fine artistic figures that are the admiration of physicians who have an opportunity of seeing them. But such cases are becoming rarer and rarer, and tattooing has become gross and vile, like every despised art.

We are indebted to the Revue Larousse for the above particulars.

Improved Practice in Surgery.

A report by M. Reclus, in one of the French journals, of several cases of severe injuries of limbs, treated successfully by a novel conservative method, has attracted much attention. Instead of removing a crushed limb, M. Reclus would embalm the injured structures in antiseptic applications and wait for a natural separation of the dead from the living parts, not interfering except to saw through bone, and after careful disinfection of the skin and removal of detached fragments of bone and of loose tendons and torn muscle, the whole wound is forcibly injected with water heated to 140 degrees Fahrenheit. Hot water acts as an antiseptic and increases the activity of other antiseptic agents, and, moreover, when injected into a large and deep wound, it arrests hemorrhage and warms the chilled and collapsed patient. The interior of the wound is next thoroughly disinfected by a solution of permanganate of potash applied on pieces of wool, and finally embalmed by what is called a polyantiseptic pomade, containing a very large proportion of active agents, some of which, being absorbable, such as corrosive sublimate, carbolic acid and iodoform, are in small quantities, while others, which are not so absorbable, as boric acid, salol and antipyrin, are distributed more abundantly. This pomade is spread quickly on bands of tarlatan, which are thrust into all the crevices of the wound. The injured part is covered with a layer of cotton wool, which is firmly bound down to the surface of the limb by bandages. By the end of the third week, it is stated, the dead have become detached from the living structures and the sloughs are quite loose.

NEW GUINEA TATTOOING.

HAIDAH TATTOOING.

HAIDAH TATTOOING.

Miscellaneous Notes and Receipts.

To Utilize Old Crumbly India Ink and Aquarelle Piece Colors.—Assort the color fragments, reduce each variety into a fine powder, and after soaking for several hours grind this very fine upon a thick ground glass plate with a glass muller used for grinding colors. Then add enough dilute solution of isinglass or white rock candy or best pure gum arabic, so that the powder can be ground into a paste. The color is then rubbed into shells or porcelain dishes and is ready for use at once and also after drying. To keep it from cracking and peeling off, a little glycerine is added. The paint heaps of aquarelle tube colors dried on the palette may also be regenerated in this manner, leaving out the glycerine admixture. Too much glycerine prevents the color from drying. Prepared with gum arabic, the color becomes more brittle than if rock candy is used for binder.—Technische Mittheilungen für Malerei.

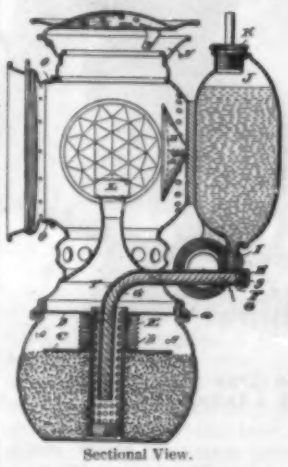
Restoration of Faded Photographs.—Place the picture without removing it from the cardboard in cold water, face downward; after a few hours renew the water, replacing it with lukewarm water. The picture will usually come off at once. When this is done, cleanse the back with a sponge of all adhering paste and lay it into the following solution: Mercuric chloride 2 grammes, kitchen salt 4 grammes, water 100 c. cm. By this treatment the picture will disappear almost entirely sometimes even becoming apparently negative if the ground of the paper is very much faded. When this is accomplished, after about 10 to 20 minutes, wash out thoroughly and blacken the photo. with diluted ammonia. This will cause the picture to reappear quickly with a brown to black tone, attaining considerable strength and deepness. It makes no difference if the picture does not entirely disappear in the quicksilver bath, which happens on account of the photo. being very strongly gilt. The copy is finally washed out for half an hour and remounted. If the prints were naturally feeble, the above operation will not be of much avail.—Dr. Adolf Miethe, Mittheilungen für Malerei.

To Nickel Plate Wood.—If one wants to electro-nickel wood, it is necessary to coat it previously with a thin layer of metal. For this purpose prepare the following three solutions: 1. In 10 grammes of carbon sulphide dissolve 1½ grammes of caoutchouc, adding 4 grammes of melted wax. In another flask prepare a mixture of 5 grammes of phosphorus, 60 grammes of carbon sulphide, 5 grammes of oil of turpentine, and 4 grammes of asphalt powder, and add this to the first solution while stirring. 2. Prepare a mixture of 2 grammes of silver nitrate in 600 grammes of water. 3. One of 10 grammes of gold chloride in 600 grammes of water. Now introduce the object to be nickeled, to which the conducting wires have been attached, into solution No. 1, and dry the whole on taking out. Next pour over it the second solution until the surface has assumed a dark metallic appearance. Rinse off with water and treat in the same manner with the third solution. Through this treatment the wood attains a yellowish color and is now sufficiently prepared for electro-nickeling. The nickel bath consists of 500 grammes of nickel ammonium sulphate, 50 grammes of ammonium sulphate, and 10 liters of water. The liquid must be neutral, which may be attained if necessary, by adding ammonium chloride until litmus paper is very slightly reddened.—L'Union pharm., 1898, 23, from Le Génie Civil.

Mumiine or Mummy Brown.—Regarding mumiine (extrait de momie), G. Buchner writes in the Bayrisches Industrie und Gewerbeblatt: As is well known, the Egyptian mummies furnish an article called mumia, much in demand for preparing a color used in oil painting (mummy brown, mumiine). This article, which is also employed as a popular medicine, is becoming more and more scarce, so that it is difficult to supply the demand, for the excavations are now permitted only under official supervision; the good mummies found are preserved for museums, while fragments are covered up again. A few years ago I was occupied in preparing mummy brown for oil painting purposes, and will give my experience with it here. I received a considerable amount of pulverized mummy in the shape of a light chocolate colored powder. On heating the powder turns dark brown black, with a pleasant, resin-like odor of incense and myrrh, then throws out vapors with an odor of asphaltum; it leaves a black glossy coal which leaves behind when burnt 17 per cent of ash with a strongly alkaline reaction, evolving plenty of carbonic acid when sprinkled with acids. In the closed tube vapors of acid reaction are obtained. With hot water a yellow brown solution of neutral reaction is obtained which smells like glue and extract of meat when inspissated, and yields 17 per cent of a yellow brown extract. From the aqueous solution acids precipitate brown black flakes which behave like humus. Alkalies color the aqueous solution darker; alcohol, ether, benzole, oil of turpentine, take up comparatively little; carbon sulphide, chloroform and spirits of sal-ammoniac more; hence the mumia behaved exactly like genuine mumia. The latter (spirits of sal-ammoniac) was used for the purification of the raw product, i. e., for the preparation of mummy brown. For this purpose the mumia was digested with spirits of sal-ammoniac (0·91) and the filtrate dried on the water bath. In this manner I obtained a handsome black brown, glossy, mummy dyestuff, soluble in water, which could not be distinguished from the French mumiine. The yield amounted to 20 per cent of the mumia. In this manner this popular and permanent glazing color may be cheaply and conveniently produced.

THE '98 SOLAR ACETYLENE GAS BICYCLE LAMP.

A lamp which cannot fail to attract the attention and secure the commendation of all bicycle riders is shown in the accompanying illustrations. It burns the new illuminant calcium carbide, which, as is now pretty generally understood, produces a light of the greatest brilliancy and steadiness, far exceeding that obtained from any other source, excepting electricity, with which alone it is to be compared. The possibilities of danger in the use of acetylene gas have undoubtedly retarded to some extent its more rapid introduction to general use, but this possibility seems to be entirely eliminated in the lamp herewith represented, and the cheapening of the price of calcium carbide renders the lamp extremely economical. It is manufactured by the Badger Brass Manufacturing Company, of Kenosha, Wis., and we are informed that, although it was not introduced until near the close of last season, many thousands of these lamps have been sold in England and on the Continent of Europe, as well as in this country. The company own and operate a complete, well-equipped factory devoted exclusively to the manufacture of acetylene gas lamps.



Sectional View.

ACETYLENE GAS LAMP.

As shown in the sectional view, the water tank, J, being filled, and the valve, I, being open, the water passes into the tube, F, which is filled with fiber, G, through which it percolates, vaporizing from the end into the screen tube, B, saturating the fiber in contact with the carbide in the tank, A, forming instantly gas which passes out of the tip, L. The amount of gas generated is due to the amount of water supplied. Should the lamp be so severely jarred that an excess of

AN ACETYLENE GAS BICYCLE LAMP.

water is forced through the wick tube, thus generating an excess of gas for the moment (by excess is meant more pressure than the one-fourth foot tip, L, can consume), the result is the gas, having but one other outlet, viz., via the water tube, backs through the wick tube, stopping any further supply of water until the pressure ceases, when it is again required. The gas and water pressure being always in balance, we have an automatic water pressure feed generator, which, with the outlet at the top of the water tank, makes it absolutely inexplosive.

The burner is a lava tip with diagonally opposite orifices, producing a large and brilliant flame, known as the fishtail flame, of very high efficiency. With the carbide compartment two-thirds filled this lamp will burn six hours, the lamp being extinguished by simply turning off the water. The carbide compartment is readily taken off and put on, the grayish ash being thrown out and the lumps retained, and the screen tube being brushed off if necessary. It is a very simple matter to keep the lamp clean and in good working order, and the carbide is furnished in small airtight cylinders which may be carried without inconvenience, no specially prepared or packaged carbide being required. The lamp has a double convex lens, 2½ inches in diameter, 5½ inch focus, readily removable for cleaning, and the bracket employed is a special universal adjustable one, which will fit head, handle bar post, fork, or the dashboard or lamp irons of a carriage. In completeness of detail and beauty of finish the lamp leaves nothing to be desired.

Patents that Pay.

Many inventors complain that "there is no money in inventions nowadays." It is doubtless true that many inventions that are patented fail to return any money to their inventors, but this may be, first, because the patented article is of no commercial use and will not attract buyers, or second, because, while the article may possess very great commercial possibilities, the owner does not possess either the capital or the business tact to push it, or holds it at so high a figure that he drives away all possible purchasers. That patented articles do sell, and sell well, may be seen by all inventors who may look up the business in all its details.

In a recently published paper in Washington, D. C., a compilation of the latest sales of patents showed that one inventor has sold a patented dispensing can for $600, another sold a graining apparatus for $500, and another sold a patent on folding wall shelves for $1,000. The same list showed a patent for the ornamentation of metal surfaces sold for $800, a clamp sold for $5,000, an amalgamating machine sold for $30,000, a clover feeder for $5,000, a sleeping car for $5,000, a fireproof floor for $1,200, a weather strip for $1,000, a boot heel for $500 and another for $1,000, a wire fence machine for $1,200, an automatic ticket holder for $750, a dispensing can for $3,500, a dust pan for $1,082, a coffee-pot for $1,500, a can-filling machine for $600, a plow for $1,000, an auger for $1,000, a printing and card-cutting machine for $50,000, a graining stencil plate for $1,500, a key for $2,500, a machine joint for $1,000, a hydrocarbon burner for $1,700, a gas lamp for $20,000, and an expansion wheel for $1,000. Some other patents sold as low as $100.

Mechanics of the inventive turn of mind may see in such a list a good deal to encourage them. The sales cover only patents. Not one of these inventions had been worked. In each case the sum of money named is paid for the letters patent, and the purchasers make all the investments needed to manufacture and push the articles. One thing to be noted in all the sales is that in each case the article is a practical article. No perpetual motion or mysterious motor sale is recorded. Mechanics should note that it is only practical inventions that can have any commercial value in the estimation of observers. Mysteries do not sell. Fads are shunned. Cranks are avoided. Yet, with all the conservatism that characterizes business men, the investors who have attempted to solve practical problems and to supply practical needs can generally secure a hearing and a customer, provided always their ideas are well worked out and put into the concrete and attractive form of a working model.—The Iron Industry Gazette.

The "Maine" Supplement.

The current SUPPLEMENT, No. 1164, might appropriately be called the "Maine" SUPPLEMENT, as six pages are devoted to the description and illustration of the building of the ship, including its destruction and the official report of the Board of Inquiry. There are twenty illustrations, showing the great frames being lowered into position, the boat on the ways in the erecting shed, the castings for the ram bow and the stern post. The launching of the vessel, the completed battleship, and the awful scenes of wreckage after the explosion are given, followed by reproductions of the official drawings in the report of the "Maine." "The Navy of Spain" is the subject of an article with nine illustrations, taken from government sources. "The Home Modification of Milk," by William L. Baner, M.D., is a valuable article for all who are in any way interested in bringing up children. "Powerful Machinery for Working Structural Iron and Steel" is also illustrated. Among the articles on natural history are "Animals Underground" and "Mimicry in Insects." "The Psychology of Invention" is an article by Prof. Josiah Royce, of Harvard University. It is the first installment of a remarkable paper dealing with the scientific and psychological aspect of invention.

A Balloon for War Purposes.

A balloon for use in war has arrived at Fort Wadsworth, Staten Island, from Fort Logan, Colorado. It is in charge of Sergeant Baldwin, an experienced aeronaut, and will shortly have a trial, should the weather prove favorable. The balloon is made of silk and requires some 14,000 cubic feet of gas to inflate it. The plan is to fit it with search lights and a telephone.

LIQUID AIR.

BY PROF. W. C. PECKHAM.

There are three essentially different methods of measuring low temperatures, all of which are applicable to any temperatures and equally reliable at any temperatures excepting very high ones, at which the instruments would melt. These will be described in the order of their development.

1. The Air or Hydrogen Thermometer.—This is based on the fact that all gases expand and contract at the same rate by heating and cooling. This rate is $\frac{1}{273}$ per degree Centigrade. Now if a cooling of one degree causes a gas to shrink $\frac{1}{273}$ in volume, it follows that a cooling of 273° would cause a gas to shrink to 0 volume and it would disappear. All heat would be gone from it; 273° C. below zero is therefore the absolute zero, at which there would be no heat, and all molecular motion would cease. Of course this temperature cannot be reached by cooling a gas, since it will turn into a liquid long before all heat is removed from it; but so long as a gas remains a gas, it obeys this law of volume and may be used for thermometric purposes.

Air is the best gas for this use, since it can be most easily procured, and does not liquefy till an extremely low degree is reached.

The air thermometer is considered the most reliable and accurate thermometer for scientific work. Hydrogen may be used in place of air for the lowest temperatures attained, since its point of liquefaction is only 32° above absolute zero, the lowest of any known substance, except possibly fluorine, while air liquefies at 83° of absolute temperature, or 50° C. above hydrogen.

2. The Thermoelectric Couple.—Here an electric current is produced by the difference in the temperature of the junctions of two dissimilar metals, and the current is proportional to this difference of temperature. The thermopile is used with a galvanometer, and the deflection of its magnetic needle is graduated by comparison with a standard thermometer, so that the effect of a difference of 1°, 10°, etc., upon the instrument is known. This is the method used by Prof. Dewar. In his lectures the thermoelectric couple was tested at 0° C. with ice. Its face was then dipped into liquid air, when it indicated —191° C. Upon applying it to the ice it returned to the 0 point again.

3. The Platinum Thermometer.—It has long been known that the electrical resistance of all pure metals is increased by heating and reduced by cooling. In this respect they differ from alloys and from carbon, the latter of which has its resistance reduced by heating.

A chart of the principal metals prepared from the measurements of Profs. Fleming and Dewar is here reproduced, Fig. 1.

The temperatures from 100° C. to 190° C. are given below, that is, from the temperature of boiling water to that of liquid air. The specific resistances are on the right. It will be noticed that the lines of all the metals given converge toward the absolute zero, from which it is inferred that all pure metals would be perfect conductors at —273° C. It will also be seen that the lines of platinum, aluminum, gold, silver and copper are very nearly straight, from which we infer that the specific electrical resistance of these metals bears a constant ratio to the absolute temperature, or the temperature above absolute zero. The lines of all these, except platinum, slope so slowly that they are not suitable for thermometric uses. That of platinum varies much more rapidly, and a coil of platinum wire may be used to measure temperature. This is calibrated by comparison with the thermopile and air thermometer at known temperatures, and it can then be employed for measurements. The method of its use is simple. It is cooled to the temperature to be determined and its resistance at that temperature is measured. Some record these degrees as "platinum degrees," so that if the relation of a platinum degree to a Centigrade degree should in the future be determined to a higher degree of accuracy, results recorded in platinum degrees would still be easily transformed into Centigrade degrees.

In the use of each of these instruments the measurements are tested through the range which is known, and it is then relied upon through a further range, below this, by a process of extrapolation, that is, its scale is assumed to be unchanged to a certain extent. The agreement of the results obtained by the various methods of measurement is the best possible reason for believing them to be substantially correct.

In addition to the experiments described in a recent issue of the SCIENTIFIC AMERICAN, certain tests were made in a lecture since given by the writer in Adelphi College. By means of a dynamometer the tensile strength of an iron wire was measured. At 58° F. it broke with 15 lb. At —312° F. it sustained a strain of 23 lb.—an increase of 50 per cent. This leads to the curious conclusion that, as the world grows cold, cohesion will become stronger, and that rocks and metals on the moon are at present much harder than similar materials upon the earth.

Alcohol 98 per cent pure was quietly frozen in a glass tube in a tumbler of liquid air. On melting it was found that the frozen mass softened throughout and returned to a liquid by first becoming of a jellylike consistency, then very viscid and last sirupy before it became limpid. This would seem to indicate that alcohol resembles iron, glass, wax and similar substances in having no definite melting point, in distinction from substances like ice, which retains its hardness in the interior and melts from the exterior at a definite temperature. The latest data for alcohol are that it is sirupy at —129° C. and stiffens at —130·5° C. (Beilstein). Mr. Benoliel, instructor in electricity in Adelphi College, made several tests before the audience. One of these was to demonstrate the greatly reduced resistance of copper at the temperature of liquid air. A coil of copper wire was fastened to the top of a box into which

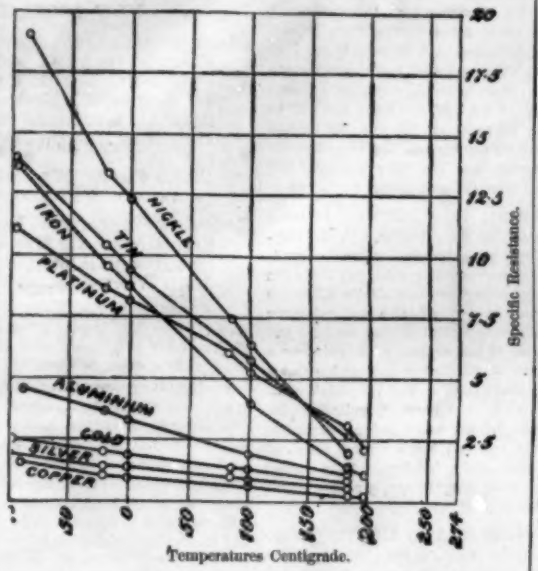


Fig. 1.—ELECTRICAL RESISTANCE OF METALS AT LOW TEMPERATURES.

liquid air was poured and its resistance was measured as it was cooled. It was shown that the resistance was very greatly reduced by cooling.

In another experiment a pair of platinum plates were immersed in liquid oxygen which was contained in a tube surrounded by a Crookes vacuum, Fig. 2. This had been made for the occasion from a design by the writer, with a straight tube 1¼ inches in diameter and 7 inches deep, covered by an outer tube, so that there was a space one inch wide around the tube. This proved to be a much better form than the ordinary bulb, since it presented much less surface to the air from which evaporation could take place, and thus preserved the liquid oxygen from all boiling. The platinum plates were placed in the liquid oxygen one

Fig. 2.—TUBE SURROUNDED BY CROOKES' VACUUM.

centimeter apart. The resistance of the liquid between the plates was found to be much greater than if it had been pure water, thus proving that liquid oxygen, though a magnetic substance, is still an insulator. Prof. Dewar concluded from experiments with an induction coil that its resistance would be about five times that of air, but in this experiment the actual resistance was shown to the audience.

Doubtless the tests which can now be made at extremely low temperatures by the agency of liquid air at atmospheric pressure will cause a revision of some of the data at present received as correct.

Electrical News and Notes.

The Longest Telephone Line in the World.—By the first of June next there will be completed a telephone system from San Diego, Cal., to Nelson, B. C., a distance of 2,225 miles. This will make a line about twice as long as the longest line now in use—that from Boston to Chicago by the way of New York.

The names telephone and microphone are older than the instruments now designated thereby. As far back as 1827, Wheatstone gave the name of microphone to an apparatus invented by him, to render weak sounds audible, and in 1845 a kind of steam whistle or trumpet which had the purpose of giving roaring signals in foggy weather was called telephone by Captain John Taylor, while Sudre used the same name in 1854 for a system of musical telephony.

The number of German towns and cities having electric railways was: 3, in 1891; 5, in 1892; 11, in 1893; 20, in 1894; 34, in 1895; 42, in August, 1896. At the end of 1897 the number was about 80. The overhead trolley is used most; three lines have a mixed overhead and underground system, two have overhead conductors combined with storage batteries, and two have the current supplied by accumulators only.—Oesterreichische Monatschrift für den Oeffentlichen Bandienst.

M. Charles Bos, in the Rappel (Paris, France), publishes as the result of a visit to Hamburg, Germany, a comparison between that city and the French capital. He finds Paris distinctly inferior in the matter of public conveyances and lighting, and says, "I would say to my countrymen: Awake! shake off your apathy, if you do not want France to count as little in Europe in twenty years as Spain does now." M. Bos is a member of the municipal council of Paris, and his warning should be heeded.—Revue Internationale de l'Electricité.

The Conductivity of Lightning Rods.—Some interesting experiments bearing on the conductivity of lightning conductors have been carried out by Prof. Koch, says Industries and Iron. He formed a chain several yards long with links of iron oxide, and placed it in circuit with two accumulator cells and a galvanometer. The chain was in a room thirty yards from the galvanometer. When a spark was discharged in the vicinity of the chain, the deviction of the galvanometer showed that the resistance of the circuit was reduced to one thousandth of its normal value, and in a second experiment the resistance fell to one ten-thousandth of the normal. Prof. Koch concludes from these experiments that they may afford an explanation why lightning conductors with poor conductivity are nevertheless effective in thunder storms. The oscillations produced provoke an enormous reduction of resistance at the proper instant to facilitate the flow of current through the conductor.

Telephone Statistics of Europe.—In no department of industry is Germany more active than in electrical appliances, says a United States consul in the Consular Reports. To our people, certainly the equal of any nation in this line, the following statistics will prove interesting. The list leaves out Norway, Denmark, Finland, Great Britain, and Portugal, because these people put down no answers to the cards of inquiry. Turkey and Greece have no telephones.

Country.	Number of lines.	Instruments.	Inhabitants to each telephone.
Sweden	200	42,354	115
Switzerland	226	23,446	129
Luxemburg	57	1,356	160
Germany	534	131,577	397
Holland	51	7,9 0	615
Belgium	15	9,400	682
France	407	31,681	1,216
Austria	194	18,950	1,818
Spain	48	10,810	1,597
Hungary	96	8,458	2,168
Italy	54	11,815	2,629
Russia	53	16,050	6,268
Bulgaria	5	243	13,616
Roumania	6	337	16,042

Submarine Cables.—The number of submarine cables throughout the world is 1,459, of which, however, 1,141 are coast and river cables belonging to governments, and of comparatively small strategic value. The total length of cable is 162,928 miles, says The English Engineer. Of this mileage companies own 148,024, and of the companies themselves 76 per cent are managed in London. France commands twelve cables of 2,033 nautical miles in European waters and thirty-three cables of 26,356 miles in colonial waters; while Germany controls eleven cables of 3,040 nautical miles in European waters and three cables of 470 miles in colonial waters. In time of war it has always been the practice for messages to pass without question through neutral states. For instance, during the recent war, telegrams between Turkey and Greece were forwarded by way of Austria, though direct communication was suspended. In the Chinese war there was no interruption of the telegraphic service with China and Japan. But in the event of war with France or Germany, 28,389 miles of cable in the case of France and 3,510 miles in the case of Germany would be deducted from the mileage control of England.

RECENTLY PATENTED INVENTIONS.

Engineering.

ROTARY ENGINE.—Claiborne W. Triplett, Leland, Ore. This engine has a cylinder with an internal offset containing the inlet and exhaust ports, the piston concentric in the cylinder having its peripheral surface in contact with the inner face of the offset, and the piston being secured on the main driving shaft, while piston heads sliding in the piston are adapted to be acted on by the steam passing into the working chamber by the inlet ports, the working chamber extending between the surface of the piston and the inner surface of the cylinder. The engine is designed to be very effective in operation, utilizing the motive agent to the fullest advantage, while simple and durable in construction.

Railway Appliances.

RAILWAY TIE PLATE.—William J. Allin, Clarendon, Ark. A rectangular metallic tie plate according to this invention has a turned-up lip cut from the body of the plate to engage the base flange of a rail, there being an aperture for a spike in alignment with the lip, and two parallel V-shaped ribs on the reverse side of the plate from the lip, adapted to be embedded in the tie lengthwise of the grain. The tie plates are inexpensive, and may be quickly locked securely in position on the ties, preventing the spreading of the rails.

SNOW PLOW.—William R. Lloyd, New York City. This plow is designed for convenient attachment to a locomotive or other motor, for readily removing snow and discharging it at the side of the track, the construction of the plow permitting convenient coupling of the locomotive to locomotives or cars ahead of it, thus allowing free use of the drawbar and the steam and air couplings. The body of the plow, of sheet metal, is arranged for extension over the pilot, and has on its upper end a movable clearer or deflector normally closing an opening in the body, but arranged for uncovering the opening for the passage of the drawbar and couplings.

Electrical.

ADJUSTABLE HANGER FOR INCANDESCENT LAMPS.—Fred C. Bell, Coeur d'Alene, Idaho. This invention relates to hangers in which the lamp is suspended from a cord wound in opposite directions upon a vertically movable spring-actuated drum, so that the light may be readily elevated and lowered and adjusted to any position desired. The device comprises a coiled spring within a rotatable drum with which the suspending cord is connected, a notched disk on the drum spindle being adapted to be engaged by pivoted dogs, and the operation being somewhat similar to that of the spring curtain roller.

MACHINE FOR RESTORING INSULATED WIRE.—Nelson Wilson, Portland, Ore. This machine comprises a winding device for winding up straightened and newly insulated wire and imparting a traveling motion to the wire, a straightening device for straightening old insulated wire, a stripping device for removing the insulation from the wire, and a covering or winding device for winding insulating fabric upon the stripped and straightened wire. The speed of the wire, as it is wound up on a drum, regulates the speed of the winding or covering device, so that the same number of turns of the insulating material is given to each foot of wire, thus insuring a uniform covering, and enabling electric companies to restore their old wire at slight expense.

Mining, Etc.

DUMP FOR ORE BUCKETS.—Hector Pepin, Victor, Col. A simple and inexpensive apparatus provided by this invention enables the engineer to attend to the dumping of the buckets as they are hoisted, thus dispensing with the services of one man, the top of the shaft being also covered while the bucket is being dumped, so that it is impossible for particles of ore to fall down the shaft. A bail or knob is suspended from the bottom of the bucket by a chain or similar connector, and a lever pivoted at one side terminates at its outer end in a fork or yoke, the lever being adapted to be swung beneath the raised bucket to embrace the knob.

Mechanical.

HACK SAW.—George N. Clemson, Middletown, N. Y. The blade of this saw is made with its cutting edge bent alternately in opposite directions, the bends being of rectangular form, with a uniform width and depth, and each bend extending over a number of teeth. It is designed in this way to reduce the friction to a minimum when the saw is used, to stiffen the blade and thus insure against breaking, and to prevent the casual binding of the blade.

WATER MOTOR.—Eli A. Rudasill, Shelby, N. C. This motor comprises a lever pivoted near its middle and having buckets pivoted to its ends, the buckets being mainly cylindrical but having tangential faces, while water-conveying spouts carried on the lever extend from the buckets upwardly and toward the center of the motor, a water delivery pipe discharging into the conveying pipes above the lever pivot. Two pivoted bars are connected to the buckets, whereby they are tipped to empty them at the limit of their downward swing. The device is entirely automatic, and will continue running as long as the water supply lasts, the construction being simple and not liable to get out of order.

Miscellaneous.

CALENDAR.—Martin Cowen, Bellaire, O. A disk in the nature of a leaf is mounted at the back of the front member of the frame of this calendar, the disk turning freely and having radial panels in which the dates of the days of a week are printed, and in each panel the name of the month, the device being in a measure a perpetual calendar, so constructed that the figures representing the days of one week only will appear at the face of the calendar, together with the name of the month, thus preventing confusion and enabling one to quickly and accurately ascertain a given date. The leaf or member bearing the dates and the names of the months may be quickly and conveniently replaced, and the leaf freely revolved upon the frame.

LIFE INSURANCE TABLE OR CHART.—Nathan P. Neal, Waxahachie, Tex. This table is designed to illustrate certain principles of life insurance and their practical application linearly, geometrically and mathematically, showing those living and paying premiums each year or any series of years, and also those who die each year or any series of years, enabling one to better understand the mathematical results. The table is based upon the number of ten thousand persons, all of whom are assumed to be insured at the age of twenty-five and all deceased at the age of ninety-one.

KINETOGRAPHIC CAMERA.—Warren B. Davis, Brooklyn, N. Y. This camera is particularly adapted for use in connection with a display device for kinetoscopic pictures devised by the same inventor, and has a master wheel for operating both the shutter and the film, the two parts being consecutively moved, whereby a series of negatives may be rapidly and conveniently made. It is also provided that whenever the shutter is brought in position for an exposure a predetermined area only of the surface of the film will be brought under the influence of the lens, the master wheel so acting upon the shutter and the film that one negative will so closely follow the other that there will be comparatively no space between them.

FLUID PRESSURE REGULATOR.—Jenkin Williams and Joseph R. Rees, Pueblo, Col. In regulators for use in supply pipes carrying natural or artificial gas, water, air, steam or other fluid, this invention provides an improved safety pressure device of simple and durable construction, very effective and automatic in operation. It comprises a chest having an inlet and an outlet orifice, one of the orifices commanded by a slide valve to which is attached a rod reciprocating through a packing gland in one wall of the chest, while a bellows attached to the rod has communication with the orifice commanded by the valve, and an expansive spring surrounds the rod and bears against the gland and bellows. In case of the breaking of the service pipe by accident or from fire, the supply of gas, water, etc., is automatically shut off.

CLOTH MEASURING AND CUTTING DEVICE.—William B. Hood, Waco, Texas. This invention comprises a support upon which a bolt or roll of cloth may be pivoted and two spaced bars by which the measuring is accomplished as the roll is unwound, means being also provided by which the cloth may be clamped close to the first one of the spaced bars and then cut by a movable knife mounted in one of the clamping bars. The device may be mounted on a plate secured to a counter at any convenient point, and is adapted to be turned as on a pivot to face in any desired direction.

BRAKE FOR DUMB WAITERS.—Charles W. Hoffman, New York City. The ends of the hoisting rope, according to this invention, are connected with slides having a limited sliding motion, and there are connections between the slides and a brake mechanism normally braking the counterbalance of the dumb waiter, whereby the brake is released when a pull is exerted on the rope. The mechanism is of simple and durable construction, not liable to get out of order, and automatically brakes the cage and its load whenever the operator lets go of the rope, on both the upward and downward movement of the waiter.

KNIT MITTEN.—Isaac W. Lamb, Perry, Mich. This invention relates to mittens in which the hand blank is knit flat and then folded over and the adjoining edges sewed together except at the thumb opening, the thumb blank being similarly folded and sewed and then sewed to the hand blank. The invention provides for a blank formed of a ribbed fabric having a main portion and a tip of a different rib style, the tip being formed by the stitches narrowed in all the courses at the inside, and with some of the stitches narrowed in the last courses at the outside of the tip.

STRAINER FOR COFFEE POTS.—Simon J. Freeman, Bradford, Pa. This is a removable strainer to be placed inside the coffee pot as an auxiliary to the usual fixed or stationary strainer. The device comprises two straining plates, an inner one with a flange and supports arranged for engagement with the body of the pot, and a forward straining plate having smaller openings than the rear one, the forward plate being supported by the flange of the rear plate. All parts of the attachment may be readily and thoroughly cleaned.

HAT PIN.—Felix Stefany, New York City. This device is designed to form a permanent fixture on the hat and be always ready for use. It consists principally of a flanged and curved sheath for attachment to the inside of the head gear, a pin sliding in the sheath, and an auxiliary pin moving with the sheath pin and extending at angles thereto outside of the sheath.

FARRIER'S PINCERS.—Hubert Wagner, Buffalo, North Dakota. This device comprises a pair of pivotally connected curved jaws with the handles curved adjacent to the pivot to conform to the curvature of the jaws and receive them when open. The pincers are arranged to open wide and permit of readily cutting into the flat surface of an animal's foot to remove undesirable matter and facilitate fitting the shoe.

BOTTLE.—Henry Weil, New York City. This is a "non-refillable" bottle, which prevents the introduction of inferior liquor after the original liquor shall have been discharged. It has a valve in its neck and a crossbar extended through a hole at one side of the neck, there being a head on the outer end of the bar, while a hole at the opposite side of the neck receives the end of the rod, a spring dog carried by the rod having locking engagement with the socket. The device is comparatively inexpensive, not adding materially to the cost of the bottle.

FLY TRAP.—William Engelbrecht, Ash Grove, Ill. This device comprises a cage in which the flies are imprisoned, and has an inlet funnel above a bait receptacle, so that the flies entering from the bait receptacle through the funnel to the cage are caught. The device is particularly adapted for catching flies in large numbers with little trouble, as the trap has to be emptied and reset only once a day.

Designs.

CUFF BUTTON.—Harold L. Palmer, Utica, N. Y. This button has a Y-shaped shank, with conical heads at the extremities of its diverging members and a base head of the ordinary button type.

WAGON BODY AND TOP.—Samuel V. Smith, Philadelphia, Pa. From an ordinary body, according to this design, rises a paneled portion simulating a greenhouse, the top having a pitch roof which is also paneled and projects forwardly beyond the body.

NOTE.—Copies of any of the above patents will be furnished by Munn & Co. for 10 cents each. Please send name of the patentee, title of invention, and date of this paper.

NEW BOOKS, ETC.

DESCRIPTIONS OF NEW OR LITTLE KNOWN GENERA AND SPECIES OF FISHES FROM THE UNITED STATES. By Barton W. Evermann and William C. Kendall. Extracted from United States Commission Bulletin for 1897. Article 5. Pp. 125 to 133. Plates 6 to 9. Washington. Date of publication February 9, 1898.

ROOFS AND BRIDGES. Part IV. Higher Structures. By Mansfield Merriman and Henry S. Jacoby. New York: John Wiley & Sons. Pp. 276. Price $2 50.

The Lehigh and Cornell professors who are the authors of this series of volumes have found, in the successive editions through which the first volumes have passed, ample encouragement in the bringing out of the fourth volume. Part I. covered Stresses in Simple Trusses; Part II., Graphic Statics; Part III., Bridge Design, and in the present volume continuous swing bridges are treated of, and an exact method given of finding the true reactions and stresses, including the cantilever and suspension systems. Arches are treated in detail under different loadings, and the subject is presented concisely and clearly, with historical information and illustration of the theory by numerical examples.

PRACTICAL ELECTRICITY AND MAGNETISM. By John Henderson. London and New York: Longmans, Green & Company. Pp. 388. Price $2.

This volume is the second of a series of physical and electrical engineering laboratory manuals, five chapters being devoted respectively to the measurement of resistance of current, of electromotive force, of quantity of electricity and of capacity, and two chapters to magnetism and electromagnetic waves. It is the intention of the publishers in these volumes to provide a course of instruction for carrying out a progressive series of experiments, arranged so that the usual laboratory apparatus may be employed in a variety of experiments, and so that, so far as possible, a student working alone may obtain satisfactory results.

DE PONTIBUS. A Pocket-book for Bridge Engineers. By J. A. L. Waddell. New York: John Wiley & Sons. Pp. 403. Price $3.

The latest as well as one of the most original and valuable of all the publications on bridge engineering is here presented, by an author who has had wide experience in most important bridge work for many years. The use of a Latin title, equivalent to "Concerning Bridges," is humorously explained as being partly due to the fact that the author, in many years' work, had never before found opportunity to employ a laboriously acquired knowledge of Latin, and partly to intimate that the book is not a complete treatment of the subject on both theoretical and practical lines. It is, however, full of valuable suggestions for practicing bridge engineers and for young engineers in offices of bridge specialists and bridge manufacturing companies, while both professors and students of civil engineering will find that a consultation of its pages will tend to aid in the wise direction of all their studies to the best attainable ends.

METEOROLOGICAL OBSERVATIONS. Made at the Adelaide Observatory and other places in South Australia and the Northern Territory, during the year 1894, under the direction of Charles Todd. Adelaide: Published by authority of the government of South Australia. 1897. Pp. 177.

PRACTICAL CALCULATION OF DYNAMO-ELECTRIC MACHINES. By Alfred E. Wiener, E.E., M.E. New York: The W. J. Johnston Company. Pp. 688. Price $2.50.

A manual for electrical and mechanical engineers and a text book for students of electro-technics, this volume is based upon actual working results obtained in practice. It presents information derived from the data and tests of over two hundred of the best modern dynamos of American as well as European make, comprising all the usual types of field magnets and of armatures, and ranging in all existing sizes. The list contains the generators in the central stations of the principal cities here and abroad, and the author believes the abundance and variety of his working material entitles him to consider his formulæ and tables as universally applicable to the calculation of any dynamo, which may be worked out by any one possessing but a limited knowledge of mathematics.

NEUBAUTEN IN NORDAMERIKA. Blätter für Architektur und Kunsthandwerk. Paul Graef. 100 Lichtdrucktafeln mit Grundrissen und Erläuterndem Text. K. Hinckeldeyn. Lieferung 4. Berlin: Verlag von Julius Becker. Price $1.50.

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Notes & Queries

HINTS TO CORRESPONDENTS.

Names and Address must accompany all letters or no attention will be paid thereto. This is for our information and not for publication.

References to former articles or answers should give date of paper and page or number of question.

Inquiries not answered in reasonable time should be repeated; correspondents will bear in mind that some answers require not a little research, and, though we endeavor to reply to all either by letter or in this department, each must take his turn.

Buyers wishing to purchase any article not advertised in our columns will be furnished with addresses of houses manufacturing or carrying the same.

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Books referred to promptly supplied on receipt of price.

Minerals sent for examination should be distinctly marked or labeled.

(7403) H. R. S. asks: Will you please tell me through the Notes and Queries of the SCIENTIFIC AMERICAN how or where I may find directions that will enable me to make a folding bellows such as are used on cameras. A. Full directions are given in SCIENTIFIC AMERICAN SUPPLEMENT, No. 625, price 10 cents by mail.

(7404) J. S. S. asks if dynamos, arcs, switches and exciters are liable to damage by lightning when working, from the fact of their being charged by artificial electricity, any more than what they would be if they were other than electrical machinery and appurtenances, or would the likelihood be greater when in a state of rest? Also is it feasible for an electrical plant (electrical machinery only) where power is generated to be struck by lightning, even where a detractor or lightning conductor is used? A. Electric lines and apparatus are probably more liable to be struck by lightning than adjacent buildings; but it is not probable that their potential due to the current they are carrying would render them more liable to such a stroke. The E. M. F. of a lightning flash is so enormous that a few hundred volts more or less makes no difference. Such lines are struck as lightning rods are because they are metallic and a better path for the current. Lighting arresters are usually effective in preventing injury to apparatus. It is thought by many that the lightning strikes less frequently in places where large numbers of electric wires are strung in the air.

(7405) T. M. P. asks (1) if the points on the interrupter of electric bells are platinum or not, and how are they soldered on or made fast to the spring of the interrupter? A. The contact points of an electric bell are best made of platinum, but in cheap bells the cost of the platinum prevents its use. Platinum can be soldered to copper in the usual manner with the ordinary soldering fluid. Clean the copper surface by scraping or by acid. Wash and coat it with solder. Clean the platinum. Lay it on the place where it is to be fixed, heat with a blowpipe or soldering copper till the solder flows. 2. About how many times the resistance of copper is water (for electricity)? A. The resistance of pure water is so high that an electric current cannot be sent through it. The addition of a minute quantity of sulphuric acid reduces the resistance greatly. Ordinary well or spring water usually will allow an electric current to flow through it; but no figure of resistance can be given for water in general. Scarcely two samples would have the same resistance.

(7406) A. E. writes: The following experiments are interesting, if not important; they may not be new, but I have never seen them or read of them. If you think them worthy a place in the SCIENTIFIC AMERICAN or SUPPLEMENT they are at your service. Cut a piece of paper or card about two inches square, and stick it against the glass of a window. Look at this card through a prism, and you will see blue at the top of the card and violet beneath the blue. At the bottom of the card you will see red, and yellow beneath it. So we get the most refrangible colors at top, and the least refrangible at bottom. Now place a second card same as the first just below, about half inch from the first, so that the blue at the top of the second card falls on or mixes with the yellow of the upper one, and the result of the union of the two, Y and B, is a beautiful green. I think this is not in accord with modern views, but the fact that blue and yellow light does produce green must be ac-

counted for. [A. This is a very pretty experiment, which we do not remember to have seen put in this form before. The principle is not new. The edges of all objects seen through a prism or unachromatic lens are fringed with colored bands by the decomposition of the light into its various wave lengths. The production of green light by passing white light through yellow and blue light is not difficult of explanation by "modern views" and accords with them, as may be easily proved by a spectroscope. The yellow seen in this case is opaque to and cuts off blue, indigo and violet; similarly the blue is opaque to and cuts off red, orange and yellow. The only color which can pass through both the yellow and the blue is green. It is therefore seen whenever yellow and blue are so placed that we look through or at them together. It is easy of pecof that the yellow and blue lights when mixed form, not green, but white, that is, they are complementary colors. In a darkened room project upon the wall the yellow and then over it the blue, by some arrangement of mirrors or two lanterns, and where both lights fall on the same space, the wall is white.—EDS.]

(7407) S. M. P. writes: There is a large difference in opinion as to whether or not an object traveling a complete circle goes around everthing within that circle whether moving or not. A says a pulley fastened to a revolving shaft goes around the shaft. B claims that it does not, but that the pulley goes with the shaft. Which is right? A. A pulley or any other revolving body turns on its axis, which is an imaginary central line. The axis does not revolve. The shaft does revolve with the pulley; therefore, the pulley does not go around the shaft. B is correct.

(7408) W. L. E. asks: 1. If a ⅙ horse power motor is catalogued voltage 8, will an 8 volt current from four 2-volt accumulators run it for its full ⅙ horse power? A. An electrical horse power is 746 watts. One watt is 1 volt×1 ampere. Any number of volts multiplied by any number of amperes are so many watts. If then you have ⅙ horse power motor and the voltage is 8, the amperes to drive it will be found by dividing ⅙ of 746, or 373, by 8, which gives 47 about. You will need 47 amperes in your accumulators. 2. Can the rheostat described in SCIENTIFIC AMERICAN SUPPLEMENT, No. 865, be used to regulate the speed of any motor, or is it only used to start the motor? A. A rheostat both starts and regulates the speed of a motor. Its office is to protect the armature coils from too much current while they are at rest or turning very slowly. 3. What is the voltage of the motors used in the World's Fair launches? If they had only 66 cells and they connected them in three sets of 22 each, they would only get 44 volts, wouldn't they? Or have the accumulators a strength of more than 2 volts. Please explain. A. See SCIENTIFIC AMERICAN for November 25, 1893, price 10 cents. There are no storage cells with more than 2 volts. 4. If a current of higher voltage than the motor is wound for is connected to the motor, will it burn the motor out? A. It will overheat or burn the coils. 5. In making accumulators, is the only advantage in size a greater ampere hour capacity? A. The size of the cell should be proportioned to the work. A cell too large wastes current.

(7409) E. A. B. asks for a receipt for making a kind of resin which is of a more sticky nature than the common resin used for violins, a kind of resin which is sticky enough so that, if applied to a violin bow and drawn across a steel string (touching very lightly), it will take effect. A. 1. For violin resin boil down Venice turpentine with a little water until a drop cooled on a piece of glass is of proper consistency. During the boiling cold water must be added from time to time. When sufficiently thick pour into cold water, knead well, and when cold break into pieces. Expose to sun until dry and transparent. 2. Select the best clear brown resin, melt it in a clean basin to nearly a boil, which will clear it of turpentine or other volatile oils. Pour in paper moulds.

(7410) J. T. H. asks which dynamo, the series or the shunt, is used to the best advantage? A. The series dynamo is not self-regulating. An increase in the resistance of the external circuit causes a decrease in the E. M. F. of the machine. This necessitates a separate regulator. The shunt dynamo acts just the reverse of this. A combination of these two, or a compound-wound dynamo, is self-regulating.

(7411) C. C. R. asks: What is the per cent of economy of a common turbine waterwheel over a Barker or reaction wheel, all things being equal? Also how much more economical is a good marine engine than a good steam turbine, under the same circumstances? A. A common turbine wheel may have any economy from 60 to 70 per cent. The best turbines have an economy of from 85 to 87 per cent. A Barker's mill seldom reaches an economy of 45 per cent. Reaction wheels of the Pelton and other types of impact jet wheels under high pressure range in economy from 80 to 87 per cent. The best types of triple or quadruple marine engines have reached an economy of 10½ to 12 pounds of steam per horse power hour; the steam turbine, from 25 to 30 pounds of steam per horse power hour.

(7412) C. A. H. says: I have understood that by introducing oxygen gas into an arc light (of the same intensity as used for street lighting purposes) that a heat could be obtained of 18,000 degrees Fahrenheit, or sufficient to fuse marble. Is it true? If not, will the introduction of oxygen gas into the arc light increase its intensity, and to what extent? A. The temperature of the arc light is quite high enough to reduce marble to calcium oxide without introducing oxygen. We doubt if an arc, except in the electric furnace, will fuse (melt) the calcium oxide. The introduction of a stream of oxygen blows the arc and cools it. If the arc were immersed in oxygen, it would doubtless be hotter and would consume the carbon more rapidly than in open air. The temperature of the electric arc is taken to be about 6,000 degrees Fahrenheit.

(7413) C. C. S. asks: 1. How to attach wires for charging American storage batteries? A. To charge a storage battery send the charging current in the opposite direction to that in which the discharging current flows. 2. How do you arrange the bank of lamps for resistance on 110 volt circuit? A. Connect the lamps in series for the amount of resistance needed to produce the drop in voltage required and then add similar series till the amount of current required will flow through the lamps.

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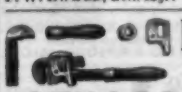

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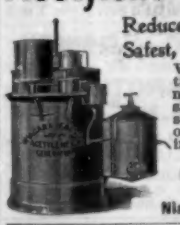

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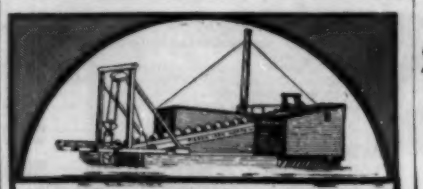

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INDEX OF INVENTIONS

For which Letters Patent of the United States were Granted

APRIL 12, 1898,

AND EACH BEARING THAT DATE.

[See note at end of list about copies of these patents.]

Abrading mechanism, W. A. McCool 602,349
Adding machine, C. C. Clifford 602,154
Air brake, J. J. Nef 602,004
Air compressor, hydraulic, W. F. Stark 602,247
Ant trap, C. W. Selvidge 602,410
Asparagus holder, C. H. Oertle 602,097
Atomizer, W. S. Frost 602,070
Automatic lubricator, A. A. De Witt 602,128
Axle, safety, T. N. Crook 602,308
Ball. See Foot ball.
Bath tub seat, W. Burrows 602,125
Battery. See Galvanic battery. Secondary battery. Storage battery.
Bearing, center, P. H. Murphy 602,099, 602,100
Bearing, vehicle wheel axle, H. C. Patterson 602,100
Bed, E. E. Munger 602,347
Bed attachment, T. H. Campbell 602,055
Bicycle, G. P. Ohlgart 602,354
Bicycle crank shaft, G. M. Beard 602,049
Bicycle driving gear, W. S. Kellogg 602,162
Bicycle frame, A. B. Simonds 602,309
Bicycle handle bar and handle, G. H. Newell 602,095
Bicycle lock, automatic, G. L. Grass 602,307
Bicycle propelling mechanism, I. W. Conselyea 602,230
Bicycle retainer and lock, J. Battersby 602,279
Bicycle rest, F. F. Hawkes 602,134
Bicycle stand, J. R. Moore 602,415
Bicycle support, H. Geidt 602,318
Bicycle support, C. C. Plaisted 602,141
Bicycle support, H. T. Sackett 602,270
Bicycles, etc., seat or saddle support for, S. C. Whitlow 602,389
Blackboard cleaner, L. A. Peck 602,266
Block system, electric, F. Burger 602,308
Bobbin, H. D. Klots 602,360
Bobbin, G. Pendleton, Jr. 602,340, 602,241
Bobbin, sheet metal, J. A. Sutcliffe 602,183
Bolt. See Socket bolt. Stay bolt.
Bolt case, H. B. Sargent 602,271
Book holder, A. L. Platt 602,169
Book, manifolding cash sales, J. H. Murphy 602,405
Book support, J. A. Loftstedt 602,164
Bookbinding, J. E. Hewett 602,401
Boot, wool, E. Roos 602,407
Bottle, L. K. Larrison 602,338
Bottle, non-refillable, H. C. Fuhimann 602,156
Bottle washer, G. P. Goulding 602,071
Box. See Collapsible box. Match box. Packing box.
Brace holder, S. Shanahan 602,367
Bracket. See Lantern bracket. Roof bracket.
Brake. See Air brake. Wagon brake.
Broom holder, L. Rybold 602,243
Brush, H. W. Hasey 602,077
Brush, C. A. Meuert 602,193
Brush, polishing, G. F. Cooper 602,058
Butter cake and means for making same, Burger & Williams 602,124
Cabinet, J. W. Place 602,103
Cabinet, lace or ribbon, C. H. Martin 602,344
Caisson air lock, S. Mattson 602,263
Can filling apparatus, oil, Campbell & Urie 602,282
Canning food, E. Norton 602,096
Canvas stretcher, J. W. Nunns 602,353
Car, I. J. Hoyt 602,359
Car coupling, J. W. 602,342
Car coupling, W. C. Perkins 602,359
Car door, grain, Newstrom & Miller 602,167
Car fender, F. A. Harris et al. 602,133
Car lighting systems, dynamo for electric, Preston & Gill 602,182
Car pilot, railway, E. P. McKaig 602,294
Carpenter's tool, B. Fuller 602,130
Carpet fastener, stair, G. F. Mardock 602,348
Carriages, suspending batteries on, Brougham & Bersey 602,302
Cart, dump, A. Maxwell 602,295
Cartridge loading and crimping machine, F. Raymond 602,143
Case. See Bolt case.
Caskets, etc., work support for, R. B. Heuchan 602,220
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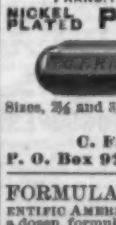

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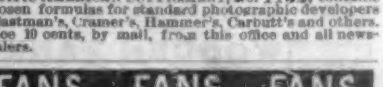

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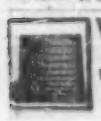

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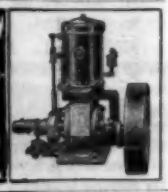

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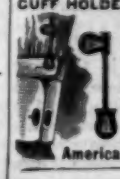

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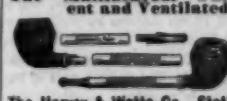

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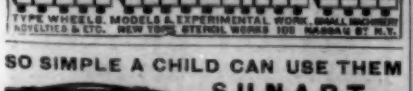

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Sash fastener, J. A. Black..... 602,051
Saw clamp and filing guide, band, C. B. Winchell 602,205
Saw handle, D. L. Green..... 602,158
Saw table gage, A. Kott..... 602,281
Saws, patching, M. D. Ahearn..... 602,295
Screw for aerial ladders, etc., elevating, A. W. La France..... 602,202
Screw slotting machine, H. Hubbell..... 602,288
Seal, T. N. Fisher..... 602,129
Secondary battery, F. W. Schneider..... 602,173
Self oiling wheel, Titus & Ensign..... 602,379
Sewing machine looper actuating mechanism, F. H. Richards..... 602,105
Shade support, adjustable, J. N. Reinhard..... 602,104
Sharpener, knife, J. W. Mailliot..... 602,192
Shears, A. Prohaska..... 602,300
Sheet metal handle, single piece, J. W. Greene.. 602,234
Sheet metal straightening and cutting off machine, F. B. Shuster..... 602,273
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Shell, vacuum protected high explosive, H. J. McKeone..... 602,092
Shoe fastener, J. Stoeh..... 602,147
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Sieve or bolting machine, oscillating, C. H. Loutzenhiser..... 602,341
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Socket bolt, E. L. A. Cureau..... 602,178
Soda water apparatus, J. F. Haines..... 602,257
Soldering machine, B. H. Short..... 602,308
Sole rounding machine, H. T. Crosby..... 602,211
Soles to uppers, machine for nailing, O. Ashton.. 602,184
Spindle, J. Duffy..... 602,254
Spindle bearing, Rushworth & Higginbottom..... 602,110
Spindle support, E. H. Ryon..... 602,171
Spinning machine heart motion, G. W. Chadwick 602,303
Spoke and felly adjuster, J. N. Rachels..... 602,298
Stacker, F. W. Elizroth..... 602,065
Stamp pad, W. A. Echelberger..... 602,061
Stamping and crushing mill, ore, E. F. Parker..... 602,356
Stapling machine, F. S. Bradley..... 602,121
Stay bolt, Johnson & Lukens..... 602,402
Steam engine, W. F. & E. W. Cleveland..... 602,302
Stool for stores, counter, Coulson & McCaw..... 602,210
Stop device, automatic safety, J. K. Wright..... 602,384
Stopper for discharge of aerating capsules, H. V. Read..... 602,269
Storage battery, G. A. Washburn..... 602,176
Stove, F. C. Wilson..... 602,118
Stove leg, Kissell & Space..... 602,335
Stove or range, H. W. Mason..... 602,166
Stovepipe fastener, J. Jones..... 602,332
Swing, reclining, W. E. Elliott..... 602,065
Tack driver, hand, J. H. Ferguson..... 602,068
Tack holder, F. W. Songer..... 602,146
Tamping machine, G. Smedeman..... 602,112
Tanbark leaching apparatus, C. Iredell..... 602,331
Tank. See Water tank. Water closet tank.
Telephone transmitter, H. E. Shreeve..... 602,174
Temperature regulator, A. Roesch..... 602,107
Testing cap and clamp, P. J. Cahill..... 602,281
Thill coupling, A. L. Crandall..... 602,307
Ticket, continuous mileage, J. P. Eastman..... 602,214
Time recorder, F. W. Cook, Jr..... 602,305
Time recorder, J. H. Gerry..... 602,286
Tire air indicator, bicycle, W. E. Richards..... 602,242
Tire lever, H. Beach..... 602,282
Tire patcher, C. A. Brachlier..... 602,052
Tires, armor for pneumatic, R. C. Hansell..... 602,133
Track cleaner, J. Hyde..... 602,081
Trap. See Ant trap. Fly trap.
Trousers creaser, J. E. Holmes..... 602,078
Trundle hoop, C. Haupt..... 602,258
Tubing, manufacturing cold drawn steel, W. A. McCool..... 602,350
Tubing, manufacturing drawn, W. A. McCool..... 602,476
Tug, shaft, H. A. Bierley..... 602,050
Tumbler washer, J. J. Evans..... 602,190
Typesetting machine, S. H. & P. R. Hodgkin..... 602,327
Undergarment, I. Goldberger..... 602,330
Undergarment trunk, L. Sittig..... 602,188
Urinal pan, T. H. Hutchinson..... 602,080
Valve, air, E. A. Rix..... 602,170
Valve gear, W. Lowe..... 602,343
Vehicle, motor, L. S. Clarke et al..... 602,283
Velocipede, marine, Grady & Hart..... 602,072
Vending machine, M. Benedict..... 602,185
Vessels, turret joint for naval, W. D. Stivers..... 602,374
Waffle iron, E. C. Perry..... 602,101
Wagon brake, J. A. Gilkey..... 602,319
Wagon, dumping, J. & G. Becker..... 602,154
Wagon jack, C. T. Jandro..... 602,259
Washer. See Bottle washer. Tumbler washer.
Water closet tank, C. Pfau..... 602,195
Water meter, J. Thomson..... 602,378
Water meters, apparatus for preventing damage to, J. Thomson..... 602,377
Water spraying apparatus, H. Gumtow..... 602,074
Water tank, Stevenson & Bailey..... 602,372
Water tower, H. C. Schmidt..... 602,344
Weigher and measure, grain, Dutton & Crawford 602,060
Welding, track, R. Eyre..... 602,284
Well drill, E. Lawton..... 602,339
Wheel. See Rubber tired wheel. Self oiling wheel.
Wheel rim joint, vehicle, Brandon & Roop..... 602,123
Whiffletree hook, F. E. Lack..... 602,136
Winding, warping and beaming machine indicator, R. Atherton..... 602,251
Windmill regulator, W. P. H. Campbell..... 602,153
Window, B. F. Richards..... 602,351
Window structure, T. H. Schmitz..... 602,345
Wrench. See Nut wrench. Pipe wrench.
Zinc for recovering zinc as oxids, treating solutions or ores containing, E. A. Ashcroft..... 602,305

DESIGNS.

Bedstead post, W. F. Bernstein..... 28,475, 28,476
Bicycle frame, J. S. Copeland..... 28,477
Bicycle toe clip, D. Basch..... 28,478
Fence post, J. P. Mohler..... 28,474
Fuse carrier, W. J. Newton..... 28,471
Garment supporter plate, L. D. Draper..... 28,467
Metallic border, D. A. Loeser..... 28,469
Parasol, O. M. Arnold..... 28,464
Saddle spring or support, J. A. Hunt..... 28,479
Sewer's trap, W. H. Elliott..... 28,473
Shade support, Page & Brundrett..... 28,470
Shoe horn clamp, W. E. Gregory..... 28,468
Skirt protector, O. S. Patton..... 28,463
Skirt protector, J. R. Poyet..... 28,461, 28,462
Umbrella or parasol cane, J. L. Brown..... 28,465
Umbrella stand, H. Ellsworth..... 28,466
Water closet flush tank, D. S. Wallace..... 28,472

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Cements, Portland and similar, Ohlemacher Lime Company..... 31,464
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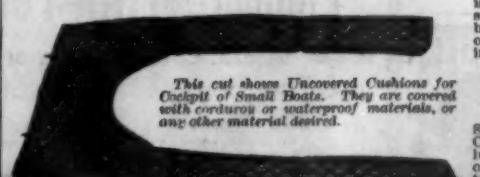

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